SCIENTIFIC AMERICAN

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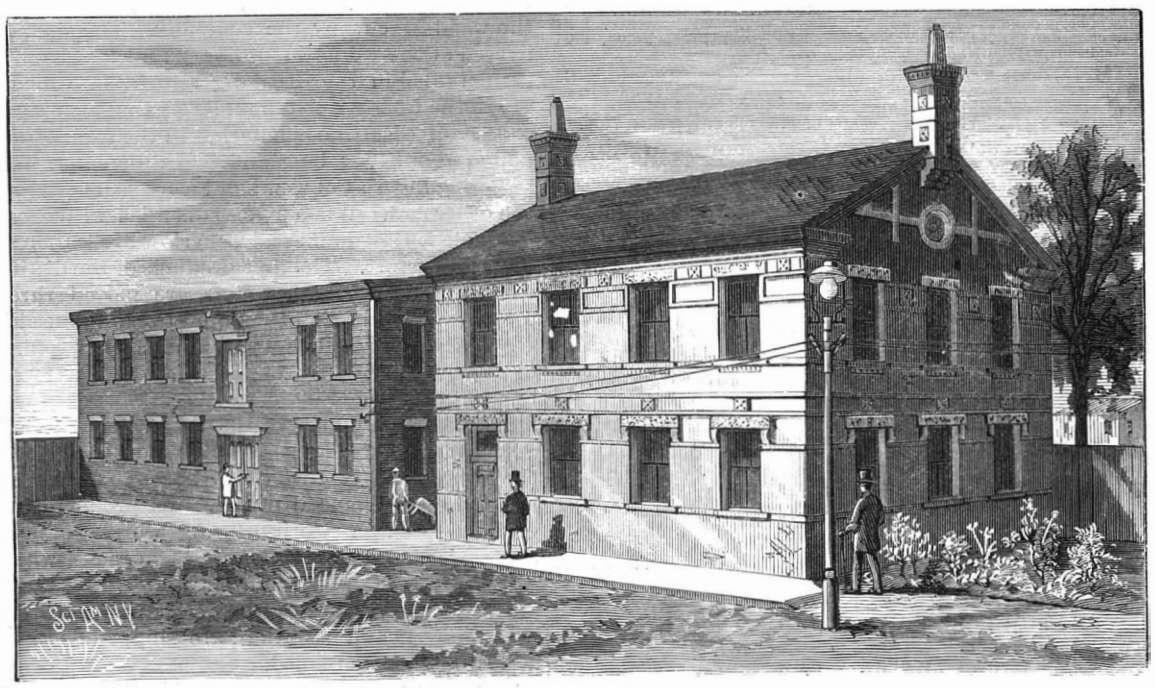
THE RESEARCH LABORATORY OF MR. EDWARD WESTON.

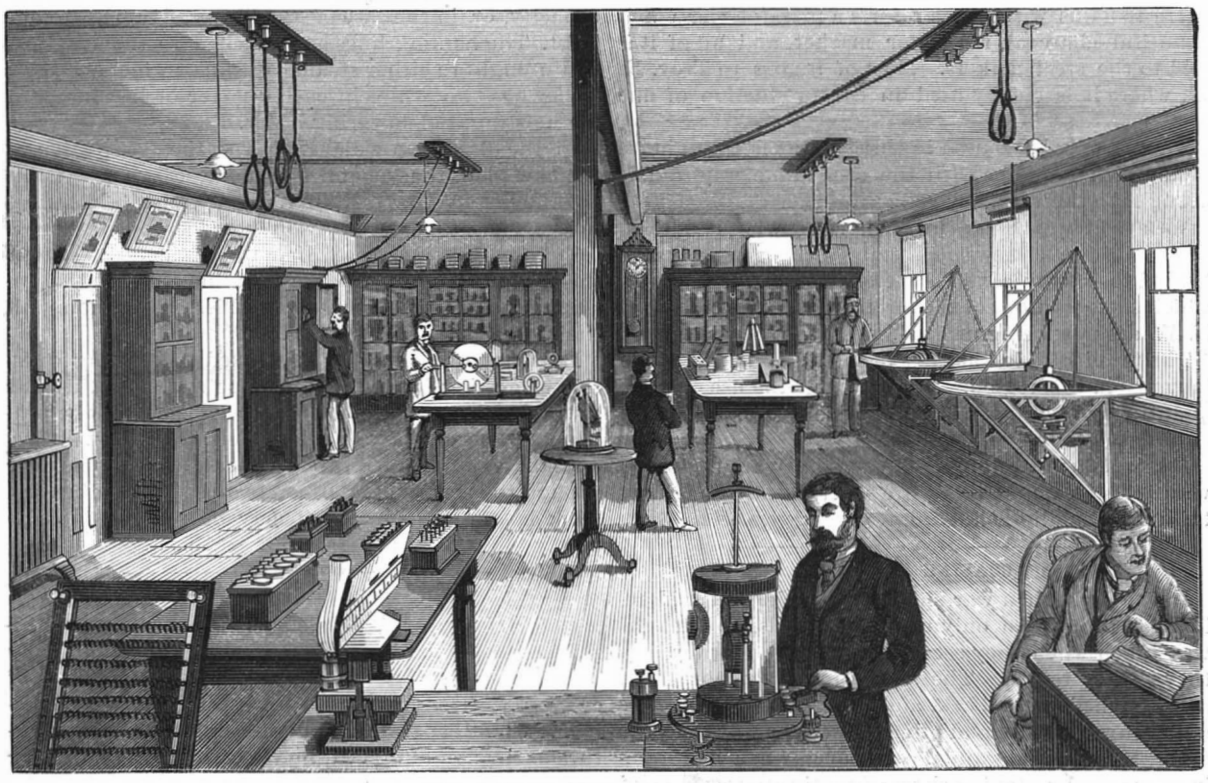
Among the pioneer names in electric lighting, as regards its development during the last ten years, none occupies a more prominent position than that of Edward Weston. With Maxim, Edison, and Brush, he stands as a representative of the American inventor. In this issue we present our readers with views of his private laboratory, recently completed.

Modern invention has now assumed a phase where the finest and most correct workmanship is needed to carry out the inventor's ideas. The models that are only experimental, as well as those representing the completed invention, have to be constructed in the most perfect manner. Unless the ideas of the inventor are well carried out mechanically, delay and discouragement will attend every step. This is not all. To ascertain how much of good there is in the more scientific inventions, a series of tests have to be applied. These must be accurate to possess any value. In many instances also the quality and composition of the materials used have to be investigated.

The laboratory we illustrate is the embodiment of such ideas. It includes, for constructive purposes, a selection of the highest grade of tools and machinery, driven by steam power. For other work it provides electrical testing and experimental apparatus, and a chemical laboratory, with all the concomitants. In its four main rooms and in its offices and smaller apartments everything is contained that can aid the inventor in quickly bringing his ideas into concrete form and determining their value when so presented.



EXTERIOR OF MR. EDWARD WESTON'S RESEARCH LABORATORY, NEWARK, N. J.



PHYSICAL LABORATORY AND DEPARTMENT OF GENERAL TESTING WORK.

The laboratory is situated in the rear of Mr. Weston's residence, in High Street, Newark. Two large buildings are devoted to the shops and laboratories proper. Between them is the boiler room. It contains an upright boiler, feed water heater, injector, and other appliances. The boiler and principal pipes are coated with non-conducting composition, and the little room is the acme of neatness and of approved arrangement. The boiler not only supplies steam for driving the machinery, but also that which is required for heating the rooms in winter.

On entering the buildings the experimental and office department is first reached. In this motors can be tested and the general running of machinery can be investigated. On one side are the offices of Mr. Weston and of his chief assistant. The main engine is situated here, immediately adjoining the boiler room, and is a model in its way. It is an Armington & Sims high speed engine, interesting as being a present from the builders. It is surrounded by a polished railing, and by belting and countershafts drives all the machinery. It is provided with indicator connections, so that its running can at any time be tested, and the indicated horse power determined. On this floor also is a photometer, on which incandescent lamps are tried to determine their illuminating power. In testing them they are photometered in various positions, in order to obtain an average result or "the spherical illuminating power." In this line Mr. Weston has made some interesting investigations, and has determined a few critical positions which give a correct average for spherical intensity. Upon the photometer table is a sphere of wood, with the relative values of different projections of light from an incandescent lamp marked upon it. In this room also are a very perfect set of rolls for rolling metal, and various other apparatus.

Ascending a flight of stairs, the machine shop is reached. A full set of Brown & Sharpe machinery is here provided, including a universal grinder, lathes, shapers, milling machines, planers, and drills. Each piece is the best that could be constructed. No attempt is made to have large or heavy machinery, the work done not being on the manufacturing scale. In addition to the lathes and other machinery, a full set of gauges is supplied. Proof planes, straight edges, steel rules, inside and outside vernier calipers, and gauges for depth, and for screw cutting, both male and female, are kept here in cases. There is much of value to be derived from their examination, and more space than is at our command might be devoted to them. They represent a complete set of mechanical standards. A dial calibrating machine is of special interest. In it the contact between the object and the calibrating surfaces is brought about by spring pressure. This elimi-

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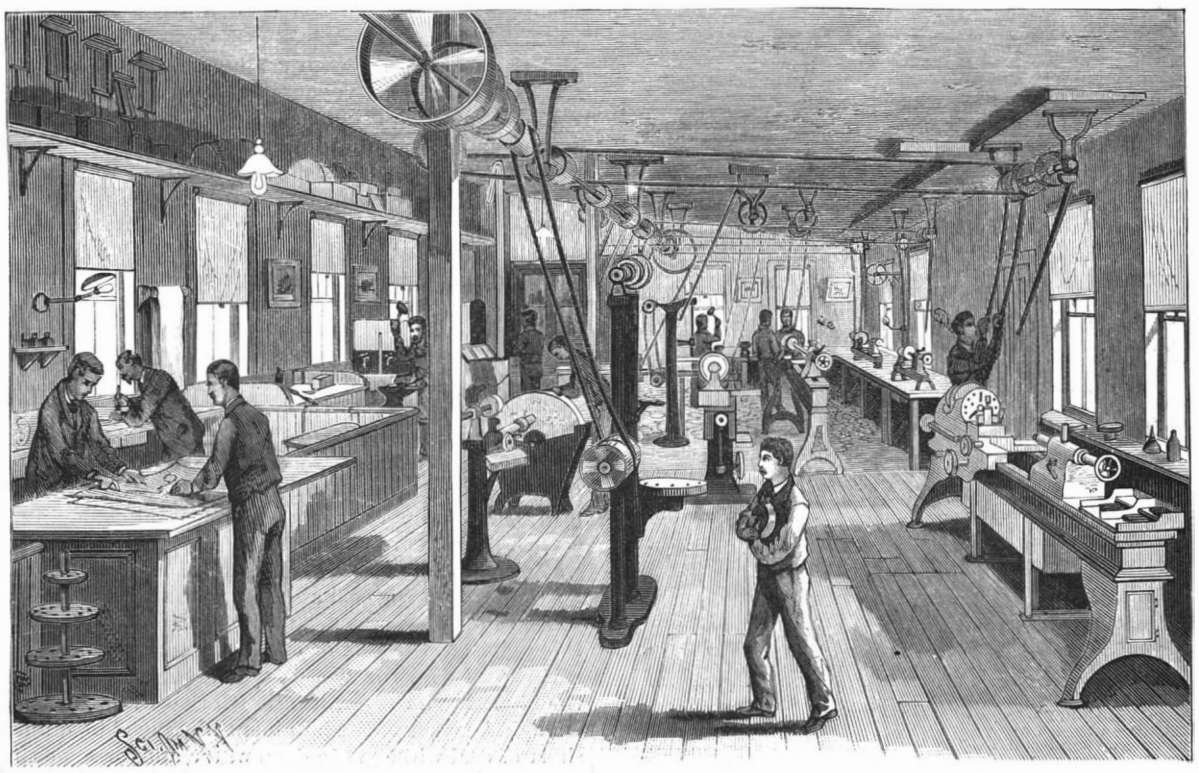

MACHINE SHOP AND MECHANICAL DRAWING DEPARTMENT.

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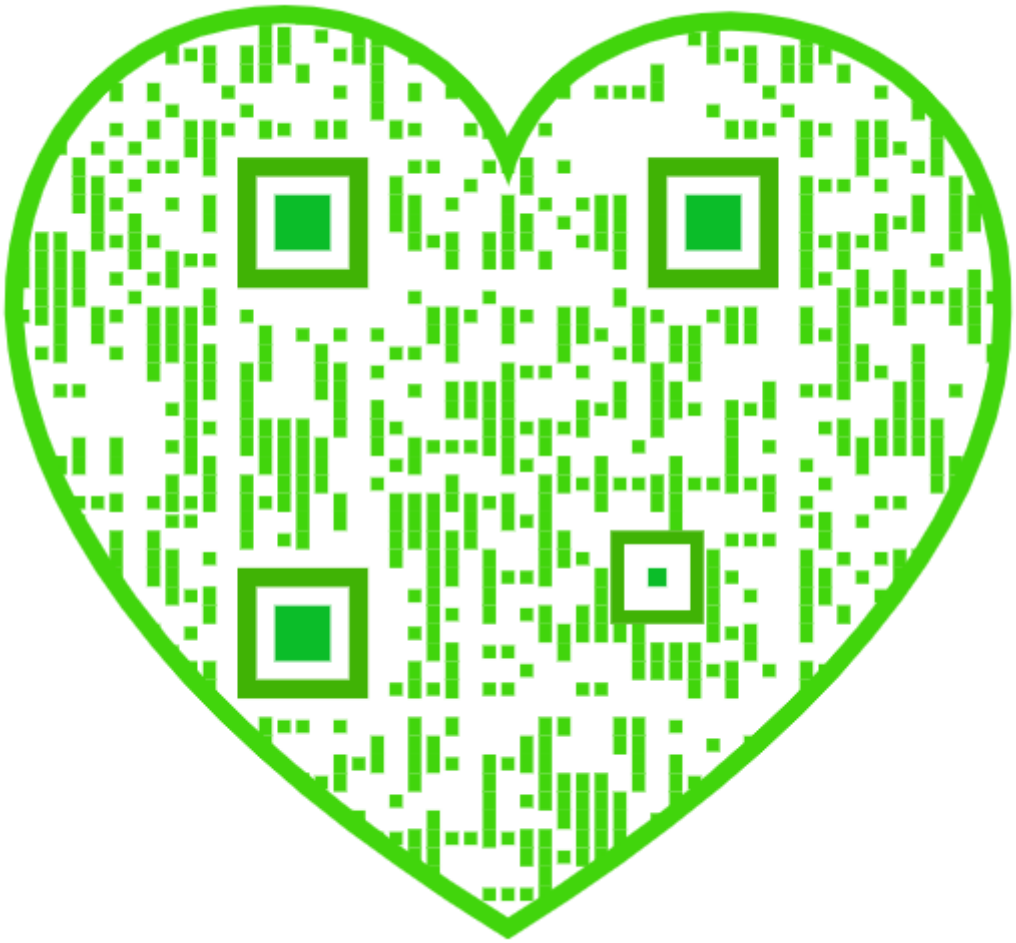

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NEW YORK, SATURDAY, NOVEMBER 5, 1887.

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DISTILLATION OF WOOD.

The Cadosia Chemical Co., at Cadosia, N. Y., has several establishments in that vicinity for the distillation of wood, which has now become an extensive and important industry.

Almost any of the harder varieties of wood will answer, but those chiefly found and used by this company, in the region it now occupies, are birch, beech, and maple. Pine, hemlock, and soft woods will not answer. The general operations and products of the company are as follows:

Contracts are made with the neighboring farmers for the purchase of standing wood, on which an agreed amount is paid in advance, balance payable as fast as the wood is cut by the company. The wood is delivered at the works in ordinary four-foot lengths and is then piled in the distilling retorts, of which there are in the Cadosia still house 24 pairs. These retorts consist of cast iron, somewhat in the form of a steam boiler, about 10 ft. long and 4½ ft. diameter, having a large manhole at one end and condensing exit neck at the other end. When a retort is filled with wood, the manhole is closed and sealed; a slow fire is then started under the retort. The first products of the distillation, consisting of alcoholic vapors, are passed through a condensing worm, and the liquid thus produced is subsequently redistilled, and this product then sold. Most of it goes to Binghamton, N. Y., where it is refined, and put on the market as wood alcohol.

The second products of the distillation, consisting of acetic vapors, are condensed as before described, and the liquid is mixed with lime, thorough mixture being effected by mechanical means, thus producing acetate of lime—used in cloth-printing works. The crude acetate is placed above the retorts on racks, where it is dried, and is then ready for market.

The third products of the distillation, consisting of tarry matters and naphthas, are shipped as produced, and subsequently refined.

The last products, consisting of heavy tars, are used at the works as fuel. When the distillation is finished, there remains within the retorts a mass of clean and beautiful charcoal, ready for market, and all of it is sold to the steel makers. Most of it goes to Troy, N. Y., where it is chiefly used in the production of fine steel.

The principal fuel used in these works is bituminous coal, which together with the crude lime required is brought to the works by railway.

We are indebted to a correspondent who resides in the vicinity for these particulars, which are only intended to convey a very general idea of the mode in which some portions of the forests in Delaware County, N. Y., are now being utilized.

The tanning of leather has been and still is a leading industry in this region. This involves the use of large quantities of bark, the trunks of the trees being sawed up and converted into lumber.

Many of the hills in the above vicinity are underlaid with bluestone, and there are several fine quarries of this noble building material.

COALING AT SEA.

In the days when war ships were under sail, and relied for propulsion only upon the winds, no thought was taken when they set out on a long journey how they should return. The same winds that bore them away fetched them back, and though the course was not always straight, and often longer one way than the other, there was not any danger, even when maintaining top speed, of falling short of motive power. Wind is easier found than coal at the end of long voyages, and now that the modern war ship is a steamer, the question of coaling becomes of the highest importance. Big ships cruise between coaling stations, and, when they set out on long voyages, their destination must be a coaling station, otherwise they cannot return. The recent maneuvers in the Irish and English Channels and North Sea showed that the great war ship of to-day requires enormous quantities of coal. Its furnaces seem insatiable, and there is good authority for saying that during the recent fortnight's maneuvers of the British fleet, it was an occurrence by no means uncommon for a ship to empty her bunkers before she could get into port, notwithstanding that a fifty mile run would have brought her there. When we consider ocean voyages, the question of fuel supply becomes really serious. Should she come into hostile waters after a long run, the chances of maintaining anything like effective activity would depend upon making a port bearing her own flag, because, under the neutrality laws, she could not coal even at a station belonging to a friendly power. The English naval authorities, always alert and far sighted, realized long ago the importance of having coal at hand, and when the present great steam fleet was yet under construction, they set themselves to the task of establishing fortified coaling stations all over the world's waters. Experience with the big ships, however, has shown that even this is not enough, because of the imminent likelihood of running short of coal while yet in deep water, and for some time they have sought to discover a practical means of coaling at sea.

So far, none has been found, though many plans have been suggested. The system of broadside coaling, to wit, laying a collier alongside, as in dock, is looked upon as wholly impracticable, and very reasonably so, because, save in a smooth sea, it cannot be accomplished without great danger. Another plan, not new, save as to apparatus for carrying it out, was recently described by a retired naval officer before the Royal United Service Institution. It consists in passing coal by means of a whip and running sling from a collier in tow of the ship to be coaled. The colliers to be used should be steamers, fast ones at that, and they ought to have straight stems, with no hamper forward in the shape of bowsprit or head gear. The originator of the plan says that she could then be brought up stem on to within only a few feet of the stern of the ship to be coaled, that is to say, near enough to permit hauling lines to be hove aboard. This, of course, could be done as easily in rough as in calm weather, if both vessels have a full head of steam up. With the aid of the hauling lines, two stout towing hawsers are passed aboard, and then other and heavier hauling lines follow. The hawsers are crossed from the stern pipes of the war ship to the bow ports, hawse pipes, or to any other apparatus convenient to special coaling, and are then made fast for towing. The two vessels now start up, holding a moderate rate of speed, just enough to keep the towing lines fairly taut. Two flexible steel wire ropes are now passed and secured in the following manner: Aboard the war ship, the ends of these steel wire cables, previously rove through two travelers with patent hooks, to be rove in turn through stout blocks, secured by wire straps at sufficient height up the mizzenmast, and the ends brought and secured to the foot of the mainmast. Aboard the collier the ends must be rove through leading blocks on each quarter of foreyard or heads of coal derricks, and ends set up to ballards or other conveniences in the gangway. Then the coaling begins either by means of tipping tubs or coal bags; the former, the designer of the plan estimates, should be of half a ton capacity, or, in the case of the latter, five bags to one hoist. The hauling lines are attached to the travelers and brought to either steam capstan or winches. Each collier has two whips in each quarter of her foreyard for hoisting and lowering away.

In the discussion which followed the description of the new plan, the general sentiment, as expressed, was of unbelief in its feasibility, the grizzled old sailors present insisting that it would be perilous to have a collier so close astern of their ships as was necessary for that; a heavy load swinging on a line between the two ships would tend to bring the collier in collision with their stern posts and rudders.

It is not unlikely that this vexed and vexing question of getting fuel at sea may be settled in the near future by the adoption of oil for fuel. Then the problem will be an easy one, for, even in rough weather, a steam vessel loaded with oil can safely come near enough to leeward of another steamer to take aboard a slack hose pipe, whence oil may be pumped into the empty tanks of war steamers.

Clean Castings.

Industries says: A Dusseldorf firm has recently introduced a device for separating the light impurities from molten iron or other metals in the operation of casting, with a view to securing pure and clean castings. The "separator" is placed upon the inlet aperture of the moulding box, and consists of a rectangular casing provided with a number of transverse partitions, dividing the casing into a series of separate chambers, which are in communication by means of openings at the bottom of the partitions. The molten metal, being poured into the separator at one end, is caused to pass through the several compartments in the apparatus before it can enter the moulding box, the light impurities being in this way caused to rise to the surface, and prevented from entering the mould with the metal. As the metal passes from compartment to compartment, more and more of the impurities are separated out, until the metal reaches the inlet to the mould in a practically pure state. Air is also effectually prevented from entering the mould together with the metal. In the second chamber there is arranged near the inlet a round iron rod, which produces ebullition of the metal, causing the impurities to rise to the surface. It is stated that by the use of this apparatus exceedingly dense and pure castings may be produced.

Two new vegetable perfumes are said to have lately become articles of commerce. One of these is a kind of *xylopia* from the province of Chirigui, in Costa Rica. The odor closely resembles that of *Canaga odorata*, and the flowers are now used, like those of that plant, in the manufacture of ylang-ylang. The other is named *ouco*, and is the highly odoriferous blossom of a kind of acacia tree which is found in Central Africa, and which Serpa Pinto was the first to describe. The *ouco* flowers are brought down the Cubangin River for sale. They cover the trees on which they grow with such profusion that they fill the atmosphere with the overpowering richness of their scent.

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Wealthy Indians.

A visitor to the Osage reservation, Idaho, if he has a mind to study the human race under varying conditions, finds much of interest. He is *inter primos* among the aristocrats. The Osage Indians are about the only example now left in the United States of a real aristocracy. They do not depend upon government rations, as do the Cheyennes and others, at all, but have enough as their own undisputed property to make them the wealthiest community in the country. Besides the land of the reservation, which belongs to them by a title hard to assail, they have about $7,000,000 bearing 5 per cent interest in the hands of the government. They are paid about $250,000 a year in cash. The entire tribe numbers only 1,600, so that they are actually the richest body of people we have.

The Osages have all the attributes of an aristocracy. They own the land, do absolutely no work, have plenty of money, know nothing of barter and sale, and therefore not much of the meanness which characterizes all commercial classes. They envy nobody, and are satisfied with themselves and their customs. With the virtues of aristocracy, they have its vices. With generosity, they have shiftlessness and laziness in perfection. Though magnificent pastures lie before them for miles, few of them take the trouble to own cattle, the majority preferring to buy beef already slaughtered and cut up from the traders. They are not even hunters and fishers. Their lives are spent in lying around under tents and shanties, eating to repletion, and filling their blood with impurities which they do not take exercise enough to get rid of. Bad habits have brought on bronchial and scrofulous diseases, which are helping to still further reduce their numbers. They have no faith in white physicians, and their own medicine men have as much influence as a hundred years ago.

The government puts a premium on reproduction by the system of distribution adopted. Each member of the tribe, including women and children, receives about $160 every year. The more wives and children an Osage has, therefore, the richer he is. In spite of this encouragement, the tribe is decreasing. A white physician at the agency estimates that the rate of decrease is not less than 2 per cent a year among the full bloods. The half breeds are increasing. It can be at once reckoned that in another half century the full bloods will have gone and the splendid inheritance will be in the possession of white men and their children, even if no new policy is adopted by the government to hasten the catastrophe.

The full bloods are nearly all honest and manly in their way. They have an idea that everything on the reservation belongs to them, and they go behind the counters and among the goods of the post traders as freely as though they were proprietors. Up to a certain point they understand business—debit and credit—but not much beyond the simplest forms. As might be expected, they are chronically in debt. They want to buy everything they see, and think little of prices, and give away as readily as they buy. Other tribes not so well provided with worldly goods are fond of visiting the Osages, and on these occasions the custom of smoking presents works to the disadvantage of the wealthier. Several hundred ponies and large amounts of various property have thus been given to the Kaws and other poorer tribes within a few years.

Can the Osages be civilized? Of course they can. They are not civilized, to be sure. They speak little English, and wear the blanket and breech clout; allow their women to die by scores in childbirth, and compel them to do all the work; they are too lazy to raise cattle when pasture and feed cost neither money nor work; they keep up the dances and paints, and cut their hair in helmet fashion. All these things they do, but they could be easily taught to adopt the customs of civilization. Five years of education scientifically applied would make them equal to the Cherokees in civilization and superior to them in force of character.—*Kansas City Times.*

Edison on the Labor Question.

Thomas Edison, the electrician, when asked by a newspaper interviewer what he thought of the Keely motor, replied: "I have never seen it, so I have no opinion about it. But all the results he is said to have obtained can be got from compressed air. All the air in this room can be condensed into a liquid that could be carried in a filbert shell, and its explosive force would be tremendous. Skillfully released and reconstructed, it would move a great machine." In reply to the question, "When motive power gets to be four times as cheap as it is, Mr. Edison, what will become of the laboring man?" "He will be enriched by it. Machinery will be his slave. See how machinery has multiplied in the last fifty years. As a direct result, workingmen get double the wages they did then, and the necessities of life cost only half as much. In other words, a hand worker can to-day buy four times as much with ten hours of work as his father could fifty years ago. For the first time in the world's history, a skilled mechanic can buy a barrel of flour with a single day's work. The machinery in the United States represents the labor of a thousand million men, or fifty times as much labor as that of all the men in the country. When motive power is still further cheapened—say in another generation—I believe that the unskilled laborer, if sober and industrious, can have a house of his own and a horse and carriage and a library and a piano. It is terrible stupidity that leads some laboring men to suppose that machinery is their foe. It is the thing that gives them independence and even freedom. Without machinery society would drift into the condition of master and slave. The multiplication of machinery means for every worker more food, better clothes, better house, less work. In fact, I believe that the indefinite increase of machinery is going to solve what folks call 'the labor question'—that is, the desire of hand workers to get a bigger slice of the margin of profit."

Distribution of Power.

The tendency of modern manufacturing is toward larger and larger establishments, owing to the fact that the *pro rata* expenses are less than in smaller ones.

The recent advances in the production of electricity and its use through electric motors seem destined to soon change our system of distributing power, if it does not bring the abnormal growth of single establishments to a sudden halt. It is well known that large powers can be produced much more economically than small ones. Hence one of the great advantages of a large manufactory. But with this advantage there is an attendant disadvantage in the accumulation of long lines of shafting and innumerable belts that have to be kept running whether they are performing any work or not. In cases of dull times, when the shop or mill is running but a small force of men, the unnecessary amount of friction thus produced has led many mechanics to recommend, and in some cases to use, a number of small engines instead of one large one. The objections to this plan are, first, it does not fully accomplish its mission, and, second, the steam and exhaust pipes are a nuisance and source of loss through condensation.

The use of the electric motor, however, accomplishes the purpose perfectly. The small motor may be run as economically as the large one. Hence there is no objection to using one for each machine. The motor may be started and stopped with less trouble than it takes to shift a belt, and when not running it is not calling for the expenditure of any power to keep the main line or countershafts going.

It is quite possible and practicable to have a large manufactory running without main shafts, countershafts, hangers or boxes, and with very few pulleys and belts. Such a plan is not at all chimerical, as it is to a certain extent in actual use in several places. In England motors have lately been applied to calico-printing machines, each machine having its own motor, which may be stopped and started independent of all others.

The ability to transmit the power over considerable distances without appreciable loss will give the small manufacturer a chance to rent a small room and obtain his power as economically as his wealthy neighbor.

This ability to subdivide and distribute power successfully and cheaply to small users is destined to put a check upon very large establishments that are likely to come into competition with them. Let us suppose a maximum amount of business distributed equally between one thousand manufacturers and one very large one, when all are able to obtain power at equal cost. In cases of shrinkage of business, the one thousand small concerns, by reason of their having more persons to solicit business, will obtain more than one-half of the business, hence they will be able to stand the pressure better.

There is another and more important result that would accrue to the community at large from a more general distribution of power to small manufacturers, and that is that in cases of depression the burden would be more equally divided, instead of falling almost entirely upon those who lose their positions in a large establishment.

But without any regard to the social side of the question, the financial remuneration to accrue from the establishment of central stations from which electric power may be measured out to small consumers, as gas and water are now measured out, will soon bring about this final result.

In general, we may expect that the development in the future will be more toward larger powers in steam engines and the division of these into smaller powers through electric motors with the necessary consequence that there will be a greater demand for persons who understand something, at least, of electrical engineering. —*Wood and Iron.*

A PAIL filled with fresh mortar fell from the top of the new Court House in Macon, Ga., and struck squarely on its bottom on the head of a colored workman who was standing on the ground. The bottom was split into flinders, and the pail and the mortar completely incased his face, so that he was in great danger of smothering until relieved by a fellow workman.

Death of Prof. Gustav Robert Kirchhoff.

The death of this eminent physicist, one who has secured for himself a historical position in the scientific world, is just announced. He died on October 17, at Berlin. At the time of his death he held a chair in the great university in that city.

He was born on March 12, 1824. His scientific work began at an early age. In 1845, a year before his graduation, he published an essay on the passage of electricity through planes. In 1846 he graduated at the University of Konigsberg. In 1848 he began lecuring in Berlin on mathematical physics. In 1850 he was appointed lecturer on experimental physics in Breslau and in 1854 he assumed the chair of natural philosophy at Heidelberg. During this period, and up to 1858, he published many essays on magnetism, electricity, heat, vapor tension, and similar subjects. He held the Heidelberg professorship for over twenty years. In 1859 he discovered that the Fraunhofer lines in the solar spectrum were due to a correlation of emissive and absorptive powers of the same ignited vapor. This led him to his great discovery, and a step further brought him to the crowning work of his life. In this he was aided by Prof. Robert W. Bunsen, one of the greatest experimental investigators the world has ever seen. The two scientists working together evolved the method of spectrum analysis, and in 1860 perfected it in its essentials. When published to the world, it at once was recognized as a classical discovery. The immense influence of it as an analytical method of investigation in terrestrial and celestial chemistry cannot be overestimated. In astronomy, the constitution of the heavenly bodies, their motions, directly toward or away from the observer, have all been investigated or determined by this method. Its applications to astronomy have recently, in some of their forms, been illustrated and described in this paper. In chemistry, new metals have been found by it, that otherwise would never have been known. Were it only for its part in completing the relation of the atomic weights of the elements, by Mendelejeff's law, the indebtedness of chemistry to it would be great. Its importance is so great, and of such increasing influence on scientific work, that Kirchhoff's name will be more celebrated through it than through all his other achievements.

In 1870, he became a member of the Berlin Academy of Sciences, and received the highest honor awarded in Germany, the Prussian order *pour la merite.* Many works and essays were published during his life. In his death the loss is felt of one who, by his genius, had made himself a pioneer in modern chemistry, physics, and astronomy, for each of these branches owes much of its recent development to him.

An Electrical Stratagem.

According to the *Electrical Review*, when the electric telegraph was first introduced into Chili, a stratagem was resorted to in order to guard the posts and wires against damage on the part of the Araucanian Indians and maintain the connection between the strongholds on the frontier. There were at the time between forty and fifty captive Indians in the Chilian camp. General Pinto called them together, and, pointing to the telegraph wires, he said: "Do you see those wires?" "Yes, General." "Very good. I want you to remember not to go near nor touch them; for if you do, your hands will be held, and you will be unable to get away." The Indians smiled incredulously. Then the General made them each in succession take hold of the wires at both ends of an electric battery in full operation. After which he exclaimed: "I command you to let go the wire!" "I can't; my hands are benumbed," said the Indian. The battery was then stopped, and the man released. Not long afterward the General restored them to liberty, giving them strict injunctions to keep the secret, and not to betray it to their countrymen on any account. This had the desired effect, for, as might be expected, the experiment was related "in the strictest confidence" to every man of the tribe, and the telegraph has ever since remained unmolested.

Trade Mark Decision.

Judge Taft, of the Superior Court of Cincinnati, has just rendered a decision of interest in the trade mark case of Societe Anonyme de la Distillerie Benedictine de l'Abbaye de Fecamp *vs.* Mihalovitch *et al.* The plaintiff, the French corporation which manufactures the liqueur known as Benedictine, brought suit against the defendants for infringement of its trade mark. The defendants contended that the word "Benedictine" was a generic word, and opposed the plea for equitable relief on the ground that the plaintiff had deceived the public into believing that its product was manufactured by monks in an abbey at Fecamp. They adduced evidence to show that the Benedictine abbey was destroyed in 1795, and that no Benedictine abbey now exists in France. Upon the part of the plaintiff it was shown that its distillery was on the site of the monastery, and that its liqueur was made from the original recipe, which is still preserved. Judge Taft decided in favor of the plaintiff, and held the defendants liable for infringement.

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THE RESEARCH LABORATORY OF MR. EDWARD WESTON.

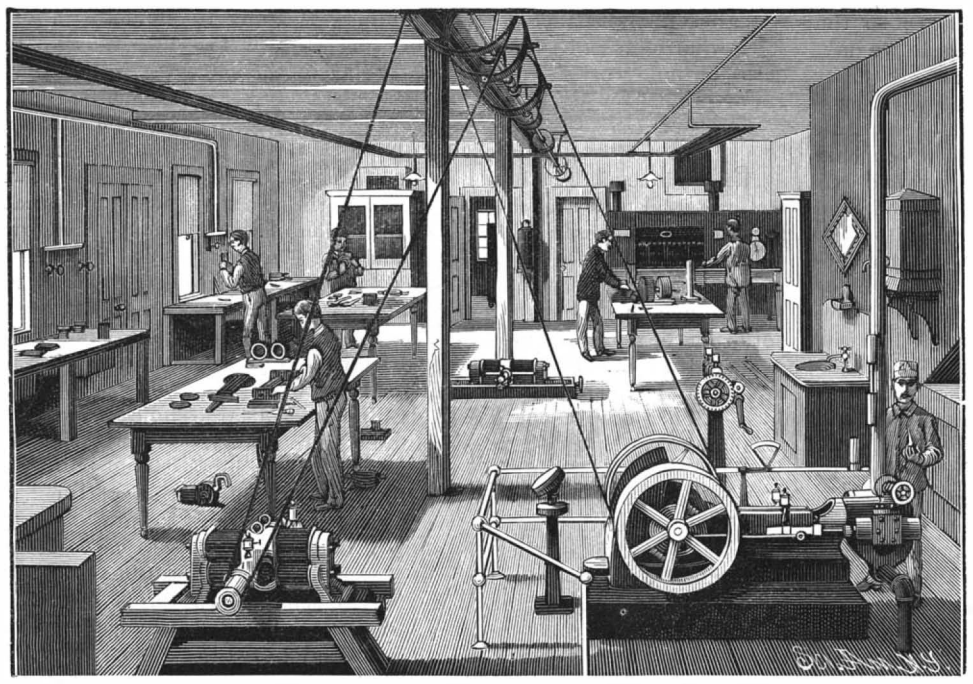
(*Continued from first page.*)

nates the personal element, so that yielding substances, such as hairs, vegetable filaments, and the like, can be accurately gauged. The readings are given directly on a dial, two inches or more in diameter.

Much of the work done in this department requires special cutting tools, and already quite an assortment of these has accumulated. They are all kept carefully in drawers. Among others, one tool for cutting out a hemispherical cavity in a copper block, used in the galvanometer, soon to be mentioned, is worthy of special notice. Its face is an accurate half circle in contour. One quarter of the circle has its edge beveled upward, the other quarter downward. It is used for cutting into the face of the block as the latter is held and rotated in the chuck. The mere construction of this tool of sufficient accuracy for the work it is called on to execute is somewhat of a mechanical triumph. Other tools of various profiles for the same galvanometer, and also for other apparatus are preserved, some of ogee-like profile, and all beautifully executed.

In one corner of the room, where the light is best, is a drawing table, where the drawings of apparatus are executed for record and for the machinists' use. For the past five years, one sheet of drawing per day has been averaged by Mr. Weston, and every sheet shows some new invention or improvement on prior devices.

The above is but a very incomplete account of all that this room contains. From the cut a very good idea of its general arrangement may be obtained.



PHOTOMETRIC AND EXPERIMENTAL DEPARTMENT.

Next to it is the balance room. This contains an analytical and assaying balances, as well as other scales for common weighing. The balances are of Becker's manufacture, and are sensitive to less than one-tenth milligramme, or about one one-hundredth grain.

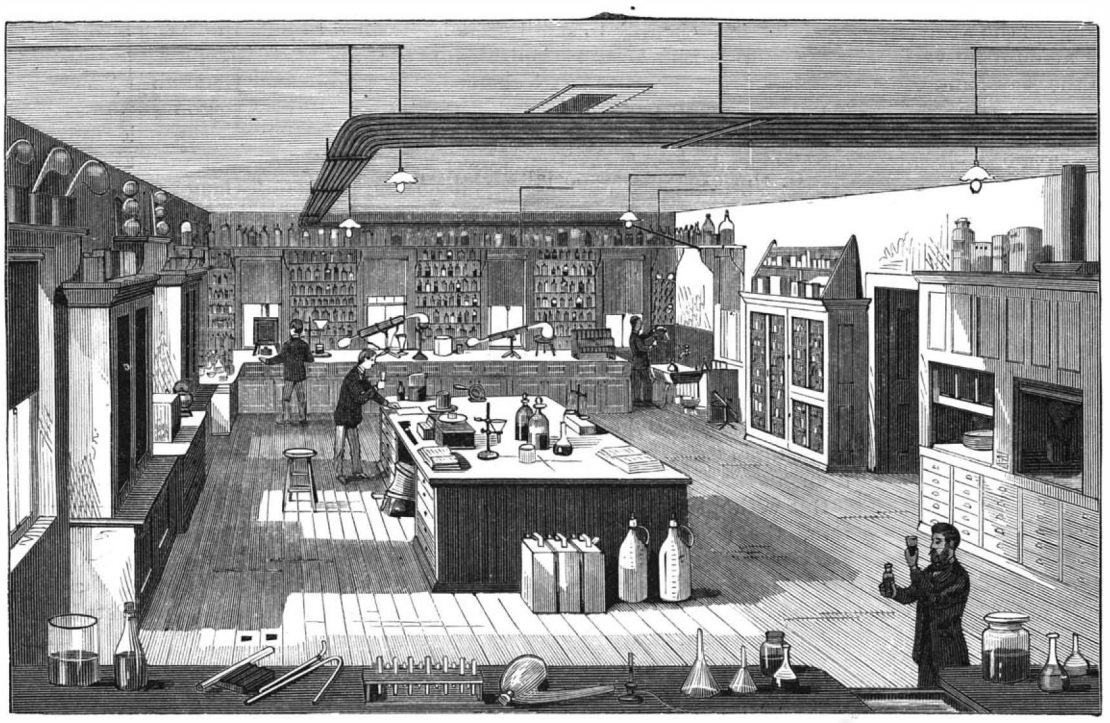
Passing through this room, the chemical laboratory is entered. In this room everything required for chemical work is kept. Supplies of beakers, test tubes, glass dishes, and crystallizing vessels, retorts, agate mortars, Berlin porcelain ware, and all kinds of chemical apparatus are stored away in the cases in profusion, or distributed and in use on the tables. The walls are lined with shelves for bottles, and a large supply and variety of chemicals are kept on hand. Closed chambers for the evaporation of acid or other solutions of corrosive or poisonous character are on one side of the room. In this room Mr. Weston has carried out the overhead system of heating. The coils are shown in the cut. They are carried around the room about three feet below the ceiling. The general action is to heat the air and cause it to rise against the ceiling. There the currents of air curve over and are forced downward, supplying warm air to the whole inclosed volume of the room. The system is found very perfect in practice. It operates without draughts, and is much more powerful than the ordinary radiator system. It resembles to a certain extent or is analogous to the plenum method of ventilation.

The working tables are to be supplied with gas, steam, electricity, hydrogen, air under pressure, and vacuum or exhaust, all by pipes or leads, and independently of each other. Each experimenter will have all these at his command.

The chemical department is not a mere adjunct of the rest. It is distinct in itself. Mr. Weston has done much independent work in chemistry, while the same science has been subsidiary to some of his most important work in electricity, notably in the production of the tamidine filament.

This substance is really the only unorganized filament ever used in an incandescent lamp. Gun cotton is dissolved in a mixture of ether and alcohol and evaporated so as to give a sheet of collodion. This is hard and horn-like in appearance, and quite devoid of any structure, being entirely amorphous. By the use of a reducing solution such as sulphide of ammonium, the nitrogen dioxide radical characteristic of the composition of gun cotton is destroyed, thus doing away with its highly inflammable or explosive character. From this sheet the filaments are cut, their width being regulated to one ten-thousandth of an inch. These are carbonized in the usual way, and form a filament resembling Russia sheet iron in luster and color

Under the chemical laboratory is the physical department. This naturally is largely devoted to electricity, and contains a large quantity of the most advanced forms of resistance coils by Elliott and other makers, and of galvanometers, reflecting and quadrant, and other apparatus, some of which were imported, and some were constructed by the proprietor. A very remarkable Sir William Thomson quadrant galvanometer is included, whose glass is quite tight, and does not "leak," a very unusual quality in this instrument, and almost impossible to attain. Against the wall are placed two reflecting galvanometers of Mr. Weston's invention, one a current and the other a potential galvanometer. They are on the tangent principle, and are of the highest degree of accuracy. Each is constructed for the reception of two coils, and by arranging these coils in series, in parallel, or in opposition, a very extended range is covered. The magnet is ring shaped and is suspended in a spherical cavity between two copper blocks, each containing one-half of the spherical cavity. The magnet carries a cross bar with sighting hole, which corresponds with a sighting hole through the inclosing copper block. By this it is adjusted for height and lateral position. The copper block acts as dampener, so as to make it almost completely dead beat. To obtain perfect contact between the two portions of the block, it is gold plated. The mirror is attached to a wire from which the magnet also hangs in prolongation of the suspending filament. Its deflections are read by a telescope, the scale for the deflections being marked upon the inner surface of the large semicircle inclosing it, which is shown in the cut.



LABORATORY FOR ORIGINAL AND CHEMICAL INVESTIGATION.

For experiments in electricity, four leads of wire hang from the ceiling, so that the work of the investigator is made easy by the accessibility of the connections. The physical department is also very fully provided with apparatus for lectures, demonstrations, and general work. Spectroscopes, a large collection of photographic apparatus, magic lanterns, polariscopes, and other physical appliances provide for illustration, for research, and for experimental work of the widest range. Two superb microscopes are ready for micro-chemical and other work.

For so complete a laboratory, a very perfect system of records is required. This is carried out on the card catalogue system, all work being fully recorded, indexed, and the description and calculations being filed away. A definite form of record book is provided for use in the laboratory, and an exact system is made to contribute to the work and records.

Mr. Weston's extensive library is not the least important element. Starting with ancient books on magnetism, it is brought down to the present day, and is constantly added to. It includes several thousand modern works and many others historically of the highest interest and now difficult or impossible to obtain.

Two of the most curious are the old works in the Latin language, *De Viribus Electricitatis*, by Aloysius Galvani, Modena, 1792, and *De Magnete Magneticisque Corporibus et de Magna Magnete Tellure*, London, 1600, by William Gilbert. These are respectively the earliest books published on electricity and magnetism.

The Preserving of Plums.

It may be worth while at this time of year to call attention to a simple and easy way of keeping damsons from season to season.

Into a clean and dry forty ounce stoppered wide mouthed bottle pour half a drachm of chloroform, then pack in a pound and a half of the sound fruit, and introduce the stopper, slightly vaselined. It is desirable to tie in the stopper with twine, as it is sometimes blown out during warm weather. For a week or two the fruit retains its natural appearance, then drops begin to exude from the surface, which gradually collect into a perfectly clear, richly colored liquid, partially filling the bottle. The fruit at the same time shrinks a little. In this condition it may be preserved without further change for at least a year, and probably for much longer periods. When eaten raw, the damsons have a slight, but by no means disagreeable, flavor of chloroform, and would be a pleasant addition to the dessert table, to be partaken of sparingly, like brandied cherries. On cooking, the chloroform entirely disappears, and the flavor is that of the fresh fruit. The quantities given above are those which have yielded a successful result, and I do not think that a less proportion of chloroform would suffice to keep the fruit. The quantity in each vessel might of course be determined by convenience, and is only limited by the difficulty of getting large bottles with perfectly fitting stoppers.

The experiment was of course suggested by the well known inhibitive action of chloroform on the functions of microbes, and several other plans were tried, such as the use of chloroform water in which to keep the plums, and of corked vessels, vaselined over, where the chloroform alone was used. Success, however, was only met with under the above given conditions, though no doubt others might be devised which would have the requisite effect of keeping in the chloroform vapor, and thus paralyzing the yeast cells and septic organisms. Probably other fruits and provisions might be preserved in the same way, though in the case of animal food the solvent action of the chloroform upon fats might interfere. The great advantage of chloroform over salicylic acid and other fixed antiseptics is that it is got rid of in the act of cooking—*Thomas P. Blunt, Pharmaceut. Jour.*

LIQUID stove blacking: Pulverized black lead 1 pound, turpentine 1 gill, water 1 gill, sugar 1 ounce.

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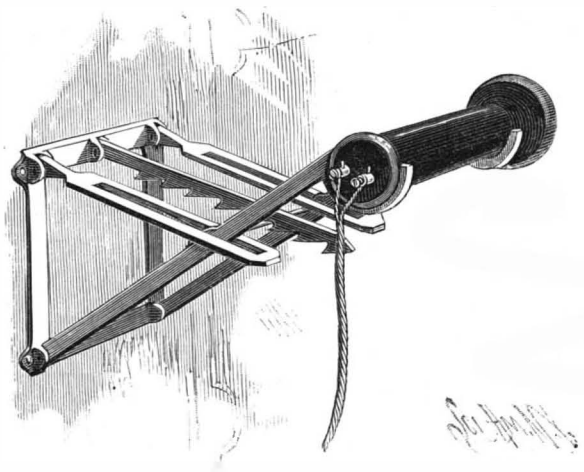
AN ADJUSTABLE SUPPORT FOR A RECEIVING TELEPHONE.

A device by which an attendant will be enabled to receive a message at a telephone, and at the same time have the free use of both hands for writing or for holding a book or manuscript, is shown herewith, and has been patented by Mr. Augustus L. Hott, of No. 183 West Sixth Street, Cincinnati, Ohio. It consists of a pair of arms pivoted to a back frame, and connected



HOTT'S TELEPHONE HOLDER.

by a rod adapted to engage a ratchet bar pivoted to the upper part of the back frame, the free ends of the arms having curved portions suitable for holding a telephone receiver. There are also slotted bars pivotally connected with the back frame to limit the swing of the arms carrying the receiver, which may be adjusted, by the ratchet bar, to any desired height to accommodate different users. When the device is not in use, the arms may be folded close against the back frame.

AN IMPROVED LIFE PRESERVER.

A life preserver which may be quickly applied to the person, which will not impede the progress of a swimmer, and which is designed to support in the water one who is unable to swim, is shown herewith, and has been patented by Mr. Charles B. Morgan, of Telluride, Col. It is preferably formed of rubber, in sections made in the form of oblong bags, adapted to extend vertically each side of the breast and back, the opposite front and rear bags being united by an integral bag extending over the shoulders, and the interiors of the sections being united by an incased tube at the back. The preserver is held in place on the wearer by bands adapted to encompass the body and by a fastening uniting the sections at the throat. It is provided with two distinct means of inflation, an air pump and a mouthpiece, either of which may be operated while in the water by turning and floating upon the back, the arms being free, as no portion of the inflated sections passes beneath or over them. The air pump shown n Fig. 1 is preferably located over or above the right breast, and consists of a bellows-like device with suitable valves, by which air may be drawn in and forced into the bags, the bellows, when not in use, being secured by a strap and buckle in close contact with the preserver. By means of a tube and mouth-piece on the other side, an extra means of inflation is afforded, this vent being thoroughly closed when the mouthpiece is screwed down to a seat.

MORGAN'S LIFE PRESERVER.

THE amount of curvature in one mile of ocean surface is 2·04 inches.

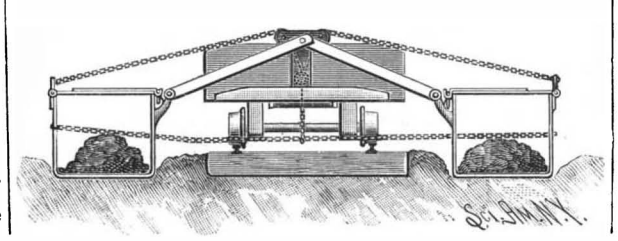
A FIRE EXTINGUISHER FOR CAR STOVES.

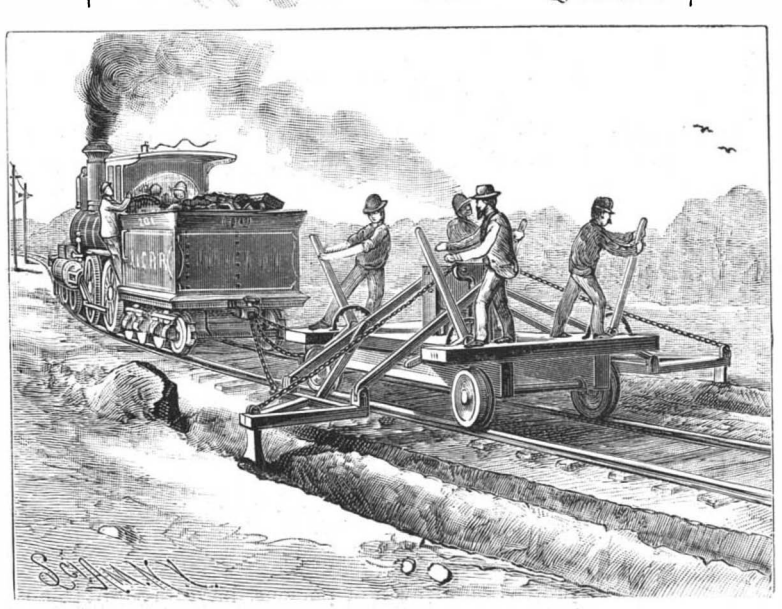
A device which is designed to extinguish the fire in a car stove, when the latter is subjected to any powerful shock or jar, as in cases of collision, derailment, etc., is shown in the accompanying illustration, and has been patented by Mr. George A. Ogle, of No. 3 South Charles Street, Baltimore, Md. Two or more tubes extend outwardly from the fire pot, having telescopically united sections on their outer ends, and their interior being lined with asbestos packing, to protect from the heat and from excessive rattling receptacles placed in the tubes, which receptacles contain chemicals by which ammoniacal vapor or carbonic acid gas is produced when the receptacles are broken, such gas being heavier than air and flowing down over the fire. Connected with these lateral tubes are vertical tubes, each having a socket near its upper end in which rests a heavy metallic ball, which will not be displaced unless the car is subjected to a heavy jar, when the ball drops upon the receptacle in the lateral tube, the latter being made of any fragile material, such as glass, which will be broken by the fall of the ball, or by the collapsing of the telescopic end sections of the lateral tube, when these sections are subjected to a strain such as that resulting from the telescoping of a car or other radical displacement from its normal position.

AN IMPROVED RAILWAY PLOW AND EXCAVATOR.

A plow especially designed for use in ditching and excavating at the side of a railway track, and which is so constructed that the plows can be readily raised and lowered, or tilted upon the truck in convenient position for transportation, is shown in the accompanying illustration. The truck is made with a strong frame, carrying a central beam, attached to the ends of which by heavy pins or bolts are bars reaching to opposite sides of the truck, two on each side, these bars having pivoted at their outer ends, on either side, a rod or plate which serves as a plow beam. One plow is secured to the under surface of the beam, and the other plow is carried by an arm extending therefrom, and also connected with the plow beam by a diagonal brace, the inner plow being located slightly in advance of the outer one. The plows are arranged to throw the furrows toward each other, for convenient removal of the earth by the excavator, and they are held at the desired angle with the bars on which the plow beam is pivoted by a brace rod which engages with a stud on the bars. The plows are raised and lowered by two front and two rear levers, each attached to a shaft having a short arm which reaches outward and bears upon the under surface of the side arms to which the plow beam is pivoted, so that when the levers are turned these short arms will lift the plow-carrying arms and their plows. Each lever has a catch adapted for engagement in a notched crest, whereby the plows may be held at any desired elevation from the ground. Instead of using this arm upon the lever shaft to elevate the plows, an eccentric may be employed, with gearing to multiply the power. The truck and plows are drawn along the track by horse power, or by a locomotive, by the side chains attached to the plow bars; but when it is desired to tilt the plows over upon the truck, for convenience of transportation, the power is applied to a central chain, which passes back under the frame of the truck, where it is connected to side chains which pass up over pulleys journaled in a central crosshead, and pass thence out to the outer ends of the arms carrying the plows.

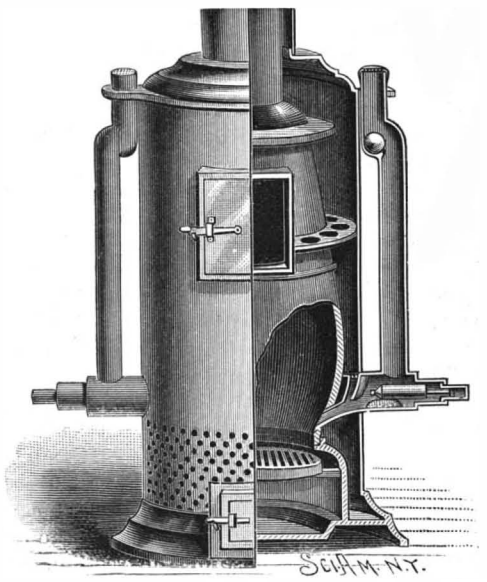
In the excavator especially adapted for use in connection with this plow, and for similar work, the side arms carry hinged scrapers, to which are attached elevating chains passing through the truck. These machines are designed for loading and transporting ballast as well as for ditching work, but the plow, when operated by a locomotive, will furnish work for at least a dozen excavators.





NEARING'S IMPROVED RAILWAY PLOW AND EXCAVATOR.

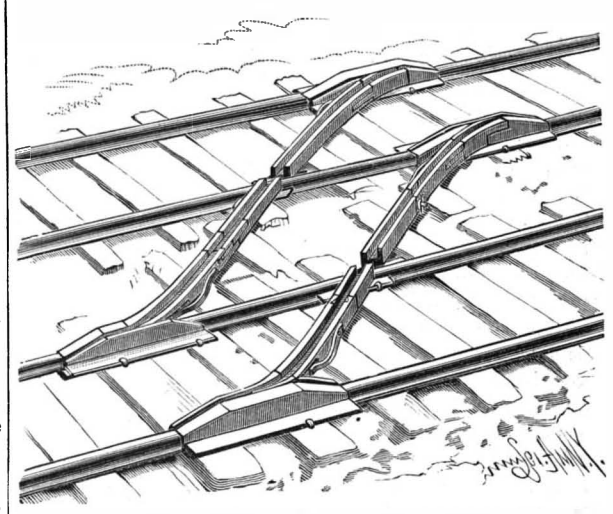
These inventions have been patented by Mr. Frank Nearing, of Browntown, Wis.



OGLE'S SAFETY ATTACHMENT FOR CAR STOVES.

AN IMPROVED PORTABLE RAILWAY SWITCH.

A portable switch for use on street and other railways, which is simple in construction, and the parts for which can be conveniently carried on a car and easily arranged in position for use at any point, is shown in the accompanying illustration, and has been patented by Mr. Otto S. Fertig, of No. 40 King Street, New York City. Switch blocks, that are preferably cast entire, are placed on each rail of the two tracks to be connected by the switch, each switch block being formed with a wide guarded cam rail adapted to rest upon the head of the main rail, and with approaches inclined upward from and tapering off finely at either end, so that a car wheel approaching in either direction on the main rail will be easily elevated to the top of the cam rail. The switch rail sections, which are to lead from each switch block to the head of the adjacent rail to form the complete switch, are each pivoted to a switch block by a pin passed through the rail section and the base plate of the switch block; and when the switch is not in use, its rail section can be folded upon the attached switch block, and the entire switch can be compactly stored away in a car for use when required. A curved hinged splice of each rail section is adapted to swing laterally into a recess formed in the top of the cam rail, and the curved splice has on its rear end a downward extension, formed with a lug projecting from its end, the lug being received and pivoted in a slot of the switch rail by the pin by which the latter is pivoted to fold upon the switch block. A spring pivoted to the side of the body of the switch rail bears upon the lug to keep it closed to cars going on the switch, but permits it to be opened by the wheel flange of a car going in the opposite direction. When it is desired to use two or more rail sections between adjacent rails, the invention provides special forms of rail joints to hold the sections against lateral and longitudinal separation.



FERTIG'S PORTABLE RAILWAY SWITCH.

SAVANTS have discovered that the hair of the prong-horned antelope, like that of man, is made to stand erect by sudden fright. Investigation in this line might take in the hedgehog and the ridge-pole cat.

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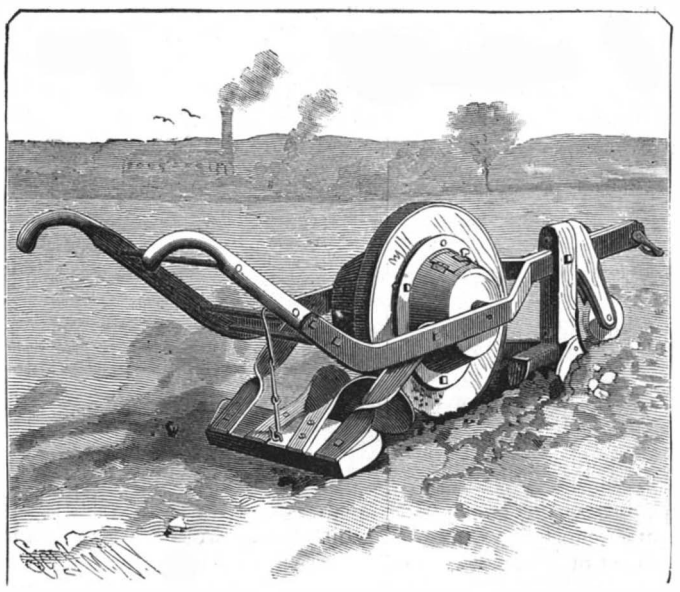
AN IMPROVED COTTON PLANTER.

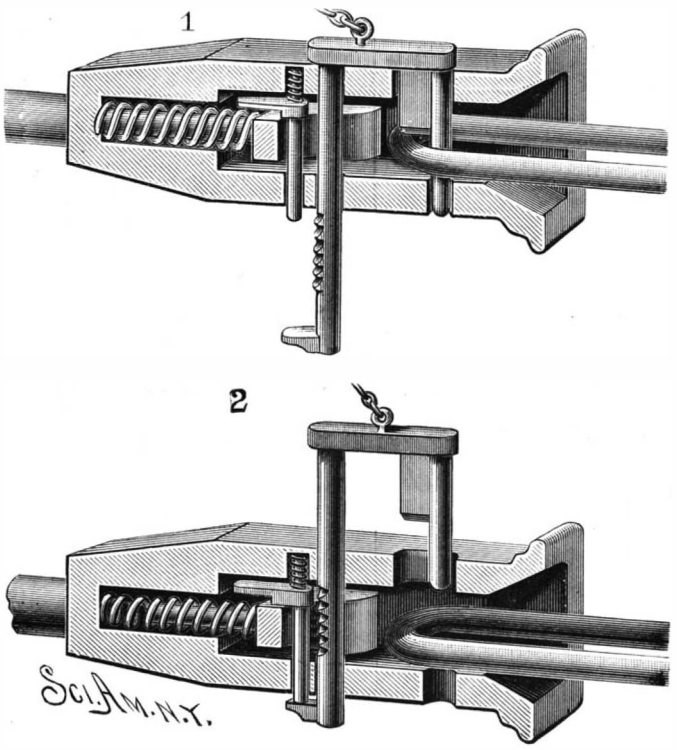
A simple and durable planter of light draught and easily operated, in which the opening of the furrow for the seed may be easily regulated as to depth and the distribution of the seed will be regular, the seed being covered with soil to a suitable depth, is shown herewith, and has been patented by Mr. William T. Magruder, of Port Gibson, Miss. Immediately behind the cotter is a small shovel plow, followed by a block having a convex under surface to keep open the furrow, each side of the block having outwardly extending wings or fenders adapted to remove any loose clods near the furrow. The seed drum consists of two cone-shaped sections mounted on a drum-carrying wheel, rotating on an axle with bearings in each side of the frame, the cone-shaped section on one side being held close against the wheel, and the section on the other side being held more or less close to the wheel by a nut upon the axle, the distance between the base of this section and the side of the wheel forming the seed opening through which the quantity of seed to be dropped is regulated. This section is attached to the wheel by bolts which carry spiral springs, against which the nut on the axle holds the flange at the base of the section, and the wheel has a central aperture making the two sections substantially one seed reservoir. Each section of the seed drum has fingers upon its inner faces to prevent clogging of the seeds and cause them to flow regularly. A covering block, adapted to trail behind the planter, has outwardly inclined share-like shovels, adapted to project forward each side of the hopper wheel, covering the seeds with earth, which is compressed by the trailing tail block. The depth of the furrow is regulated by the leverage afforded the operator using the frame through the handles as a lever, the fulcrum being the drum-carrying wheel.



MAGRUDER'S COTTON PLANTER.

AN IMPROVED AUTOMATIC CAR COUPLER.

A car coupler designed to hold the link in horizontal position, and wherein the coupling pin, when raised to uncouple the cars, will be automatically released by the action of an entering coupling link, is illustrated herewith, and has been patented by Mr. Luther B. Sampson, of Rochester, N. Y. Fig. 1 is a central longitudinal section, representing the parts as they appear when the coupling pin has fallen to engage the link, and Fig. 2 shows the pin raised to couple automatically with an entering link. In the rear of the drawhead is a bore in which is housed a spring which bears against a bifurcated grip, the grip having a rearwardly extending shaft about which the spring is coiled. Upon the inner faces of the grip arms are ribs adapted to engage shoulders on a vertical shaft or bar, the lower end of this bar having a step or toe, and a coupling pin being connected to the upper end of the bar by a crosshead. Above the grip is mounted a catch, which is connected to a short shaft or bar in vertical apertures, the shaft and its catch being normally held depressed by a spring, and to the rear of the coupling pin, beneath the crosshead, is a weight or block. By raising the coupling pin and the parts connected with it, which may be effected from the top or sides of the car in any of the well known ways, the toe of the vertical shaft back of the pin will strike against the lower end of the short shaft attached to the catch, raising the latter, so that the spring around the rearwardly extending shaft of the bifurcated grip will force the latter forward into engagement with the notches of the vertical shaft connected by the crosshead with the coupling pin, and hold the latter in the position shown in Fig. 2. If the drawhead be entered by a link, when the parts are so adjusted, the striking of the link against the forward rounded faces of the grip forces the latter back, whereby the coupling pin is free to drop to the position shown in Fig. 1. With the parts in this position, the weight at the rear of the coupling pin, beneath the crossbar, bears upon the link to hold it in horizontal position, so that it will enter the drawhead of an approaching car.



SAMPSON'S AUTOMATIC CAR COUPLER.

Remarkable Salt Vein.

At a depth of 1,000 ft. from the surface of the ground, near Ithaca, N. Y., a vein of pure natural salt 250 ft. thick has been struck. The discovery was made during an experimental boring in search of gas.

A Water Bicycle.

Prof. Alfonso King has a water bicycle, which consists of two spindle-shaped tubes about 12 ft. in length and 1 ft. in diameter. The tubes are united by an iron framework, which also carries a light water wheel with pedals and a bicycle saddle. This novel boat was lately tried by the inventor in N. Y. harbor. The wind was blowing a small gale, and a strong flood tide was running, and the sea was being chopped into angry waves, which aroused doubts as to the seaworthiness of the novel craft. The little boat skipped over the waves, and the professor worked his pedals with admirable energy. In forty-five minutes from the time of the start, at Liberty Island, the bold navigator ran under the Brooklyn Bridge. Distance, about three miles.

The Brotherhood of Locomotive Engineers.

The twenty-fourth annual Grand International Convention of the Brotherhood of Locomotive Engineers was held in Chicago on the 19th October, with delegates present from all parts of the Union. The Grand Chief Engineer, P. M. Arthur, with his usual rare good sense, said in the course of his annual address: "We are enemies only to wrong in its various devices and garbs, and can assuredly say that political schemes and aspirations have no place nor part in our association. A mighty army of men, representing 365 divisions, has gathered about a nucleus of 12 men who, 24 years ago, assembled in the city of Detroit and started an organization destined to be more than they knew or dreamed. To-day we number 25,000 men, and while our numbers are great, we would not have you consider only the quantity, but the quality as well. To be a Brotherhood man, four things are requisite, namely: Sobriety, truth, justice, and morality. This is our motto, and upon this precept have we based our practice. We have paid out during the fiscal year just closed, to widows and orphans, $259,500, making a total of $2,244,669.61 that we have paid since the association was established. Our *Journal's* circulation has now reached 22,000; from which we derive a revenue of $8,922.84 per year. Taking all things into consideration, our relations, both to ourselves and with various railroads employing Brotherhood men, are amicable. When we consider the dissatisfaction which is everywhere manifest about us, our few troubles pale in insignificance. There have been times and incidents when the 'strike' was the only court of appeals for the workingman, and the evil lay in the abuse of them and not in the use of them. The methods used to bring about a successful termination of strikes, the abuse of property and even of persons, have brought the very name into disrepute, while the troubles of the laboring man are receiving mere cant, and sympathy for him is dying out. More and more clearly defined is the line becoming which divides the honest man, satisfied with a just remuneration which he has truly earned, until by his own effort he can rise to a higher position in life, and the loud-voiced 'bomb thrower,' who, scarcely able to speak the English language, seeks to win his own comfortable living from those who have worked for it, presuming upon the imagination and arousing false hopes in the hearts of those who are still more ignorant than himself. Among sensible men the day for all this is past. Let 'mercy season justice, and justice be tempered with moderation.' A wise arbitration looks to a long result rather than to immediate satisfaction, and accomplishes more than intimidation ever can hope to do.

"It is not my intention," said Mr. Arthur, "to impose upon this convention any dogma upon the drink question; but I cannot refrain in honesty to my own convictions from deploring the sad havoc that intemperance is making in the ranks of our fellow men. So great is this evil that no man or woman who is striving to improve their fellows can help taking it into account. It is, indeed, an important factor for evil in our midst. Not only from the physical and moral standpoint is it working mischief, but from the standpoint of labor. The man who has so little self-control that he cannot resist the temptation to degrade himself is always in danger of bringing disgrace upon his brethren. He has lost his self-respect and, to some extent, his independence, thus making an easier victim to the greed of a selfish employer. I would therefore urge upon you the necessity of abstaining from everything that will in the slightest degree impair your usefulness as citizens or your efficiency as locomotive engineers."

Progress of Electrical Improvements.

Electrical progress has been almost in keeping with the inconceivable speed of electricity. But a few years back, within the memory of all our readers, what a paltry corner of usefulness was occupied by electrical invention! A few improvements in batteries, and the then wonderful development of the electric telegraph in its various modifications, comprised about the whole crop visible in the field. At the Centennial in 1876, only eleven years ago, some feeble attempt was made to show that electric light could be produced from a dynamo, which was spoken of as a "very interesting exhibit." Professor Bell's first crude telephone attracted thousands of curiosity seekers, and the verdict was "a beautiful conception, but a mere scientific toy." Professor Gray exhibited various forms of what has since become one of the mighty arms of multiplex telegraphy; but most people looked askance at the models as the "in'ards of a church organ," and passed them with indifference.

To-day, only eleven years later, the arc lights of the United States are fast approaching two hundred thousand, while the incandescents have long since passed the million mark. It would be but a one-horse telegraph company that did not use the duplex and quadruplex systems almost exclusively; the harmonic's dainty song is heard everywhere; electroplating has got to be an indispensable adjunct to a great body of industries; the telephone has become the business man's *fidus Achates;* a solid phalanx of electric motors are slowly but surely pushing the small steam plants into the scrap pile, with the moral support of thousands of domestic motors, sons of the same sire; and the knell of the poor street car horse has been tolled. We are surrounded with a myriad of small devices, such as alarms, annunciators, gas lighters, mine exploders, impossible to catalogue here. And we have several very sturdy infants growing. Already electric smelting has taken a strong position commercially; electric welding—or more generically electro-smithing—has come to stay, and will soon take its place in the rank and file of labor-saving inventions; storage batteries are gradually giving up their secrets and becoming amenable to scientific law, and they have a vast field of usefulness awaiting them. The review becomes bewildering, and the mazes of possibility are inexhaustible. Where will it end? Nowhere in our lives. As the years swell into decades, and the decades round into centuries, it will be found that the true flood gates of improvement were opened by the discoveries and practical applications of electricity in the decade now completed, and the onward and ever widening torrent will end only at the crack of doom. —*Electrical Review.*

A Spring of Acid Water.

About fifteen miles south of Meridian, Miss., there is a spring near the foot of a hill. The water is almost as sour as lemon juice. With the addition of sugar it makes first-class lemonade, with a slight taste of iron. The spring was recently discovered, and it is not supposed to possess any value except as a curiosity.

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An Incandescent Gaslight.

About two years since, we were afforded the opportunity of privately inspecting an incandescent gaslight, which was then in a more or less incomplete condition, although it gave good promise of success. This was the Welsbach incandescent gaslight, which, since that time, has been perfected in all its details and put through practical trial. Its promise of success has been realized, inasmuch as it is now the subject of manufacture on a commercial scale. The inventor is Dr. Auer von Welsbach, under whose system the gas is burnt completely, without smoke, and the heat thus produced is taken up by an incandescent body and converted into brilliant light. The incandescent body, which is termed the mantle, consists of a small cone of incombustible matter, in the shape of fine gauze. When heated to incandescence over a small Bunsen gas burner this mantle emits a brilliant light, due to the metallic oxides which are employed in the preparation of the mantle. As the mantle is incombustible it remains intact, and does not change in any manner until after several hundred hours' use. A comparatively low temperature being required to raise the material to a state of incandescence, no special apparatus for producing great heat is required. The burner is perfectly silent, and free from any hissing noise.

Of course, as our readers are aware, there have been several prior attempts to produce an incandescent gaslight, but those efforts have not been attended with commercial success. We may here instance two of the more recent examples, namely, those of Clamond and Lewis, both highly ingenious and praiseworthy. Clamond used a pottle-shaped mantle made from filaments of magnesia prepared in a special manner. Lewis used a similarly shaped mantle of platinum wire, and produced more perfect results than did Clamond. But both systems had a fatal drawback in that they required compressed air for insuring perfect combustion. This defect is absent from the Welsbach burner, and this circumstance in combination with its other good points has made it a success. We have stated that this gas burner is manufactured on a commercial scale. Having recently inspected the process of manufacture at the invitation of the Incandescent Gaslight Company, of 15 Leadenhall Street, London, it will be interesting if we now place the particulars before our readers.

The works of the company are situated in Palmer Street, Westminster, and we found them to be a busy hive of industry, where female labor is chiefly employed, for in their manufacture the mantles require that delicacy of manipulation which more muscular fingers rarely command. The first process is the manufacture of the tubular netting, which is produced in lengths of several yards by means of circular knitting machines, a special kind of cotton being employed. These lengths of netting are passed on to another room, where they are cut into suitable lengths, which are transferred to the saturating room. Here they are one by one dipped in a chemical solution and sent in batches to the drying room. When dry they are returned to the saturating room and dipped in a second chemical solution, after which they are again dried in a gentle heat. The ingredients of the solutions are the oxides of zirconium, lanthanum, thorium, and cerium, and they form a coating around the cotton filaments. After the second drying the mantles have a platinum wire run around the edge at one end, which is then contracted, and the ends of the wire are used as points of suspension in the next operation, which is the burning out of the cotton fiber from the chemical coating. This is done by means of a gas flame from a Bunsen burner, which destroys the cotton and leaves a skeleton of practically indestructible material, that is, so far as heat is concerned. The mantles are now mounted on their frames, and are subjected to a second burning, which occupies about twenty minutes. The third burning then takes place within a glass chimney, and lasts from two to three and a half hours, at the end of which time the mantle is ready for the market. They are made of different sizes, the ordinary size being 4 inches long and about 1 inch in diameter when finished. They are also made of two different tones, one of which gives a pure white light, and is suitable for artistic purposes, and in connection with industries where it is important to distinguish various delicate tints. The other mantle gives a faintly yellow light, and is used for domestic and general lighting. These differences are produced by variations in the solutions.

In use the incombustible mantle mounted on its metallic framing is fitted over a simple Bunsen burner, the gas being admitted at the bottom of the tube through a perforated disk, and the air passing in through holes in the tube just above the disk. The regulation of this burner for pressure is a very simple matter, as was shown. The durability of the mantles is very considerable; they are computed to last from 800 to 2,000 hours. A number of these burners are in use on test in one of the government offices, and the mantles are reported to have already stood 1,700 hours' use without manifesting signs of deterioration. With respect to the economy of gas resulting from the use of the Welsbach burner, we cannot do better than refer to the report of Mr. Conrad W. Cooke, M.S.T.E. After having had some of these burners under his constant observation for fifteen months, Mr. Cooke states that the economy is very remarkable. Thus, while a standard Argand gas burner, as certified by the Board of Trade, consuming 5 cubic feet of gas per hour, has an illuminating power of 16 candles, showing an efficiency of 32 candles per cubic foot of gas per hour, the Welsbach burner produced a purer light, with less heat and absolutely no smoke, of the same candle power with 2 cubic feet of gas per hour, thus effecting a saving of about 60 per cent. If the Welsbach light be compared with the ordinary nipple burners in general use, the saving of gas for the same illuminating power is very much greater. The perfect combustion attained in this burner was demonstrated during our visit to the works in question in a practical way. To our mind, however, the most satisfactory proof was that of the burning room, where several hundred burners were under test. The room was very hot, but there was a total absence from the atmosphere of those sulphurous fumes evolved from gas burned in the ordinary manner. To sum up, we obtain with the Welsbach system a maximum of light with a minimum of cost for gas, a decreased quantity of the deleterious products of combustion, and a diminution in the amount of heat resulting from combustion—qualities which constitute a perfect gas burner.—*Iron.*

A Plant Destructive to Sweet Taste.

The *Wien. Med. Blat.* says that lately a drug which possesses the property of rendering our sense of taste unsusceptible to sweet and bitter has aroused the interest of the London medical circles, as it is hoped that by its aid our as yet limited knowledge of the physiology of the sense of taste may be extended, and that it may prove a valuable addition to materia medica. The drug, which reached the manager of the King's Gardens at Kew through the Governor of Madras, Sir Montstuart Grant Duff, was examined by Professor Thisleton Dyer, etc., and the statements made above corroborated. David Cooper delivered a lecture on the subject lately, at Ootacamund, from which the following is stated: "The drug is obtained from Gymnema sylvestre (R. Br.), an asclepiadaceous plant, which inhabits the peninsula Deccan, Assam, and the coast of Coromandel; it also occurs on the continent of Africa. It is represented as a strong, woody, climbing plant, with long, thin branches. The leaves are from 1½ to 3 inches long, 1 to 2 inches broad, entire, elliptical to egg-shaped, and occasionally cordate at the base, covered with woolly hairs; the upper surface is dark green. The plant is alluded to in the Indian Pharmacopœia. The powdered bark has long been employed by the Hindoos as a remedy for snake bite. For this purpose the decoction is applied externally. But the most remarkable property was discovered by Captain Edgeworth, who found that after chewing the leaves the tongue lost its capacity of distinguishing the taste of sugar or anything sweet. Powdered sugar had no taste whatever, feeling like so much sand in the mouth. This effect lasted for 24 hours. It is remarkable that the sense of taste for sour, acrid, burning, or salt substances is not impaired. When under the effect of this drug, sulphate of quinine tastes like lime. The lecturer found that the peculiar effect did not last 24 hours, but passed off in less than two hours. The chemical analysis showed the drug to contain two resins, of which one is soluble in alcohol; the other, which is present in greater quantity, insoluble. Through suitable treatment, an organic acid was separated, which bears some resemblance to chrysophanic acid. This acid, gymneminic acid, possesses the property of the drug, and constitutes, combined with an undetermined base, about six per cent of the leaves.—*Phar. Record.*

Ivy Poisoning.

A writer in the *Popular Science News* gives the treatment which he has often found serviceable in his own case when poisoned with ivy:

I have always been extremely susceptible to the poison of poison ivy and oak, so as to give me great annoyance, unless it is immediately checked on its first appearance. This common washing soda accomplishes for me, if properly applied. I make the application by saturating a slice of loaf bread with water, then cover one surface with soda and apply to the eruption, the soda next the flesh. When the bread is dried by the animal heat, I drop water on the outer side, so as to keep it thoroughly moistened, and dissolve the soda crystals in contact with the skin. This, you will perceive, is merely a bread poultice, the bread being a vehicle through whose moisture the soda reaches the humor. I find that washing or bathing with soda water, even continuously, will not suffice with me. My skin requires the heat and moisture of the bread in order for the soda to act on and neutralize the poison. I rarely have need to retain this soda poultice for more than thirty minutes to any affected part. No pain ensues. Formerly I suffered often for weeks, as the poison would spread all over my body. Now thirty minutes measures the duration of its exhibition.

Candy Making.

The mother who stops and buys a stick of candy to pacify her child would probably be surprised if informed that candy manufacture is one of the great industries of the city; that thousands of men, women, and children, many thousands of dollars' worth of machinery, and whole great buildings are called into play in appeasing the sweet tooth of humanity. The young man who stops to count up the expense of the many boxes of French mixed he has presented to his best girl with the oft-repeated motto, "Sweets to the sweet," perhaps would not be so much surprised. Candy is a luxury, pure and simple, and there is no better way of observing how the luxuries of life must be holding their own in the popular demand, side by side with, and sometimes at the expense of, the necessities, than to spend a few hours in a candy manufactory. Such an establishment, on a large scale, has its chemist, its designer, a number of skilled hands trained by years of labor for certain special branches, and scores of more ordinary workmen. Sugar is bought by the ton, starch and glucose in large quantities, cocoanuts by the car load, besides cochineal, prepared fruits, etc.

The business may properly be divided into two general branches—the making of stick candy and of the various fancy kinds. The most interesting branch by all odds is the first mentioned, and is as much of a revelation when seen for the first time as glass blowing. The mixture, after boiling, is thrown in a plastic state on large stone slabs, where it runs out flat into thick sheets. These sheets are repeatedly picked up, doubled over, and kneaded together until they become of the right consistency, when they are rolled into one immense cylinder of a grayish color. A narrow strip of the same mixture, colored red with cochineal, is laid along one side of the larger piece and adheres to it. Little strips of a shade made whiter by pulling are also laid lengthwise and all around that cylinder equal distances apart. This gives an immense stick of soft, gray candy, with one big red stripe and several white ones, all running lengthwise on it. A man with a pair of gloves on takes hold of this and pulls it out the whole length of the long table at one end of which it lies, runs his closed hand along the sugar rope thus made with such dexterity as to make it perfectly round and of the exact size he wishes, twists the rope once or twice to make the stripes run round it, and, presto! there is a stick of candy as long as a fish pole. All this is done quick as a wink, the long, pliant ropes squirming into place like snakes under the magician's hand, until the whole table is covered with them. When they are cool, they are cut into the right length with a peculiar pair of shears. There is as much stick candy sold as all the other kinds put together. The operation just described requires a workman who has had years of experience.

Making the various kinds of fancy candies is a more complicated matter. There is a designer, whose business it is to continually invent novel devices, artistic forms and imitations of nature—frogs, bugs, mice, fruits, nuts, etc. These devices are reproduced in plaster of Paris, and several of a kind fastened on a stick. The instrument thus formed is repeatedly stamped into the level surface of boxes of pulverized corn starch. Into these holes in the corn starch the prepared sirup is turned, and cools in the required shape. The candy is then placed in pans and sirup turned over it, which, after several hours, cools and covers it with crystals. Then, when exposed in the gaslight, it sparkles and appeals to the eye as well as the palate. All this trouble has been taken to probe the young man's pocketbook, and the reflection should afford him some satisfaction when spending his last dollar.

Great quantities of fruit, especially the quince, pear, apple, and apricot, are consumed in the manufacture of candy, giving their flavor to the finished confection. The manufacture of motto candies ought to interest sentimental people. The material of these tender little *billet doux* is made plastic by means of gum tragacanth, kneaded like dough, and rolled out, as if for cookies, with a long rolling pin. The mottoes are then stamped on by means of a copper stamp dipped in cochineal dye, and lozenges cut out with a cutter, square, round, or heart-shaped. Sugar is confessedly sweet. But a sugar lozenge, with one of these mottoes on it, is "sweeter than anything on earth." Many a schoolboy, in the flush and fury of his first young love, has laid his heart on one of these lozenges, as on a platter, and sent it to some rosy lass. What could be more effective as a feeler than this: "Your eyes are bright as diamonds"? It contains the whole science of courtship—flattery.—*American Analyst.*

It is said that two per cent by weight of finely pounded bottle glass, placed at the bottom of the crucible in which red brass is being melted for castings, gives great hardness and at the same time ductility to the metal. Porous castings are said to be almost an impossibility when this is done, and the product is likely to be of great service in parts of machinery subject to strain. An addition of one per cent of oxide of manganese facilitates working in the lathe and elsewhere where great hardness might be an objection.

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The Value of Physics to a Mechanic.

If the ordinary, every-day workman, engaged at his bench in the pursuit of his vocation, were aware of the enormous number of natural laws by which his every action is controlled, he would be surprised at their existence and desirous of learning about them. This desire would be natural and most praiseworthy, yet the fear of study seems to prevent those who would like to gain this knowledge from simply reading, as one would a story, the interesting things described in books on physics—facts far more valuable than fiction, and so clearly demonstrated that a mere tyro can understand and experiment from description, thus proving how much can be learned even from a rapid perusal.

Why should a woodworking mechanic study the science? The reasons why he should do so are numerous and important, and in explaining some of them we shall endeavor, as far as possible, to show its practical application and the part it plays in his individual efforts, though, at the same time, it must not be forgotten that all the movements on this earth of ours depend on and are controlled according to the principles of natural philosophy.

Let us consider for a moment its bearing on a man standing at a bench in the act of pushing forward a jack plane. What first of all retains his body on the floor on which he stands? The force of gravitation, which, as described, *retains* the earth particles together, and all bodies animate or inanimate on its surface, by drawing them to its center, this influence being exercised on the building in which he labors, retaining its constituents in their positions. It also acts on his person to such an extent that were he devoid of the power of movement, he would be as immovably fixed as the inanimate wood he stands upon. This force, likewise, keeps his stuff on his bench and the plane on his work, and prevents the flying off at a tangent which would occur with all terrestrial bodies were the attraction to cease for a moment. How simple is the fact when demonstrated!

Avoiding the consideration of the different attractions, we will glance at the mechanical means he goes through in planing. Standing with his two feet together, would it be possible for him to lift a shaving? It would not, because the resisting force generated by the friction of the wedge-shaped iron in entering the woody fibers would be so great that his body, being unable to resist it, would be pushed outside the perpendicular line of gravity, and fall. To overcome this resistance he increases his base, and lowering the center of gravity of the body, leans forward and throws his weight on his left leg, with his right forming, as it were, a brace.

Now he can exert his powers effectually, for having overcome unvarying natural forces by the use of natural laws.

His arms, as he moves them forward or draws them back again, are nothing more than a splendid system of compound levers, and the tool employed is on a cubical prism, with an angular opening into which a wedge of steel is inserted and fastened, with its point projecting below the sole or lower face. This wedge is forced forward by lateral pressure, and entering the wood gives out a shaving or strip equal in proportion to the projection.

How many of us are there who know that the edges of our plane iron and chisels, saw teeth, in fine our principal tools, are modifications of a simple wedge, and fewer still who know its power or how to increase its utility in practice.

To us who handle it daily, the screw, or as it is in reality a revolving wedge, is a mystery and an unknown thing, though we are familiar with its usefulness; yet, while in the act of propelling a screw with a screw-driver, a multitude of forces and machines are employed, which are grand in their simplicity and worthy of study.

That which teaches why a plumb bob hangs quiescent at the extremity of a string, and why a level is determined by the centering of an alcoholic bubble in a tube, and other valuable mechanical facts, should not be passed over by him whose philosophy is to devote his life to improving the means by which the comfort and happiness of human nature are gained. Independent even of this essential reason, it is imperative that we make ourselves acquainted with the component parts and properties of materials, in order to train the mind into a line of thought tending to invention and the bringing forth of valuable ideas, which only those familiar with this science can essay.—*Builder and Wood-Worker.*

RAISING LIQUIDS BY COMPRESSED AIR.

In many industries it is necessary to raise liquids stored in casks in the cellar to an upper story of the building. We have recently visited an establishment where this operation is effected by means of compressed air. The compressing of the air is performed without any expense, in this case, by means of city water led into a special reservoir. This system, which was devised by Messrs. Sainte & March, engineers for Mr. Lebeault, proprietor of the Bugeaud medicinal wines, has appeared to us to be of sufficient interest to be made known, as it is capable of being applied to any other liquor of value.

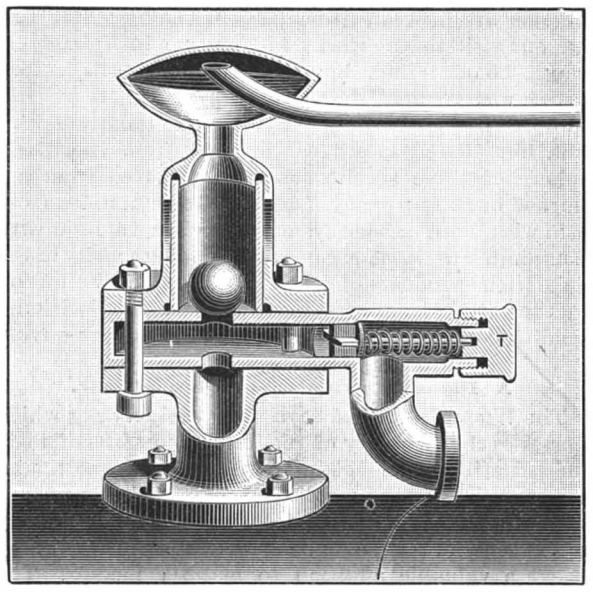

Fig. 2.—BALL VALVE.

In the establishment under consideration, the liquid to be raised is very costly, and, as it would undergo alteration in contact with metals such as iron or copper, all the vessels that are to contain it are lined with tin, and all the pipes and cocks are of the same metal.

As already stated, the agent by means of which air under pressure is obtained is city water, which is made to pass into a reservoir before being used for washing bottles, so that the consumption of water is not increased by this mode of work. Besides, the use of pumps is avoided, the maneuver of which is troublesome and requires time, and which so stirs up the wine as to affect its quality.

In Fig. 1 we give a general view of the arrangement. In the cellar are the tuns, one series, G, of which contains Malaga wine just as emptied from the casks. Each of these tuns is provided beneath with a three-way cock, which puts it in communication with a general conduit ending in an elevator reservoir, E. Into this latter is led the quantity of wine that it is desired to raise to the mixing apparatus, P. A float, the extremity of whose rod is visible through a glass tube, I, shows the level of the wine in the elevator.

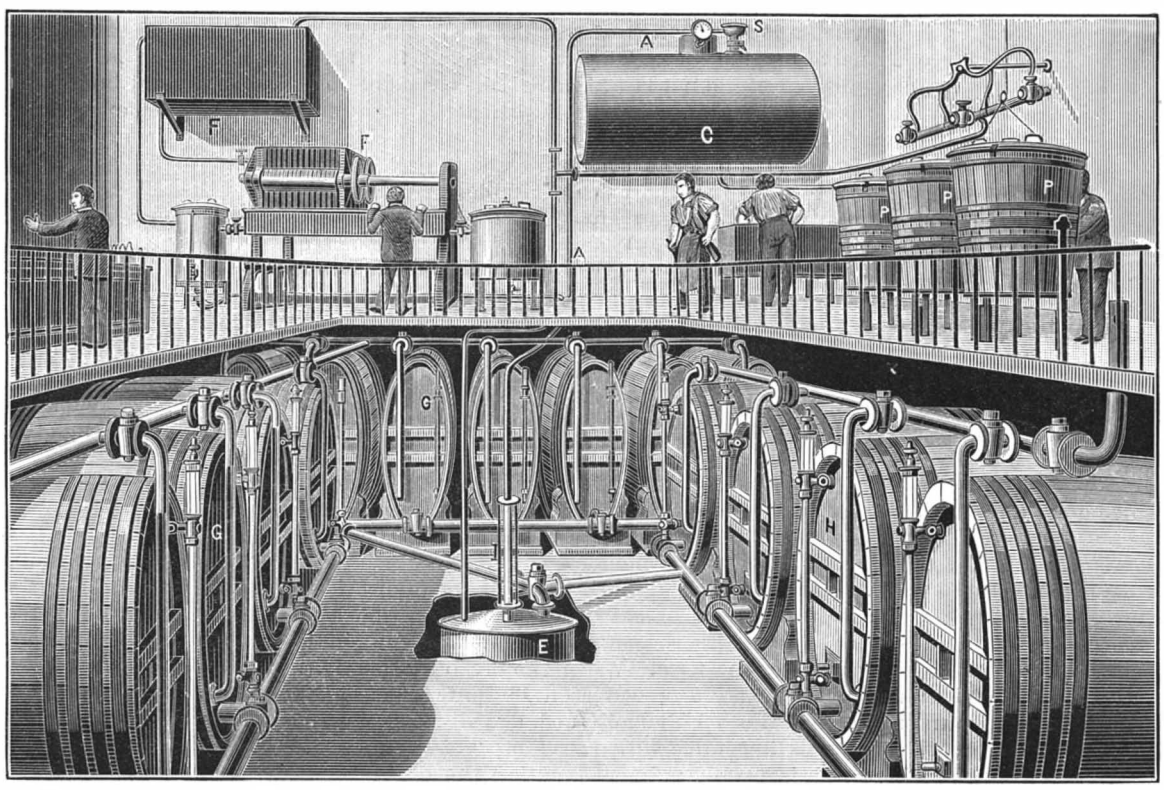

Fig. 1.—RAISING LIQUIDS BY COMPRESSED AIR.

The compressing is effected in a reservoir, C, which communicates through the upper part with the elevator through the intermedium of a conduit, A A I. The water enters at the bottom and expels the air, the pressure of which, shown by a gauge, gradually exerts itself upon the wine in the elevator and causes it to rise to the mixing apparatus. From these latter, the liquid, converted into Bugeaud wine, descends to the tuns, H, of the second series, where it remains for some time. Before delivering it for consumption, it is necessary to make it pass into a filtering apparatus, F, situated on the ground floor. Hither the proper quantity is sent by the same process as before. From this apparatus the wine passes to the bottling machine.

In order to prevent a portion of the water coming from the compressor from entering the air pipe, a float cock is so arranged as to shut off the water when the compressor is full. But, as float cocks are apparatus that cannot be thoroughly depended upon, Messrs. Sainte & March have interposed a safety device, S, at the branching of the air pipe. This device is shown in Fig. 2. It is a ball valve in which the ball is lighter than the water. As soon as the latter enters, the ball is carried along the surface and closes the upper orifice of the valve. The little water that might pass is held back in the small reservoir, R. A spring clack, whose spring has a tension regulated by the nut, T, allows of the escape of the water, as if through a waste pipe, as soon as it exceeds the limit beyond which it ought not to go.—*La Nature.*

To Crystallize Tin Plate.

Crystallized tin plate has a variegated primrose appearance, produced upon the surface of tin plate by applying to it in a heated state some dilute nitro-muriatic acid for a few seconds, then washing it with water, drying, and coating it with lacquer. The figures are more or less diversified, according to the degree of heat and relative dilution of the acid. Place the tin plate, slightly heated, over a tub of water, and rub its surface with a sponge dipped in a liquor composed of 4 parts of aquafortis and two of distilled water, holding 1 part of common salt or salammoniac in solution. When the crystalline spangles seem to be thoroughly brought out, the plate must be immersed in water, washed either with a feather or a little cotton, taking care not to rub off the film of tin that forms the feathering, forthwith dried with a low heat, and coated with a lacquer varnish, otherwise it loses its luster in the air. If the whole surface is not plunged at once in cold water, but is partially cooled by sprinkling water on it, the crystallization will be finely variegated with large and small figures. Similar results will be obtained by blowing cold air through a pipe on the tinned surface while it is just passing from the fused to the solid state.—*Spons' Workshop Receipts.*

Mahogany for House Finishing.

The *Northwestern Lumberman*, which is good authority on the commodity of wood, informs its readers that people whose tastes favor mahogany for inside finish can now indulge them without paying much more money than they would for a finish of the higher priced native hard woods. To do this, however, the mahogany must be bought as lumber. If a man unacquainted with the price of mahogany bargains with a contractor to finish one or a dozen rooms, as the case may be, in what has sometimes been called the "king of woods," he may depend on it that the price will be a round one. Furniture manufacturers take the same advantages of their customers. They seem to think that because mahogany is not a common wood, because it is very fashionable, and in former days was expensive, consumers will take it for granted that they must pay a good deal of money for mahogany furniture. It is enough to make the initiated smile to walk through a furniture house and price articles made of the different woods. There may be a table or chair of cherry and mahogany standing side by side. The same amount of work has been expended on each, but for the mahogany article at least two prices are asked, when the fact is the wood in it did not cost 25 per cent more than did that in the cherry piece. But simply because it is mahogany a fancy price is wanted. Furniture users will undoubtedly for all time be obliged to pay these exorbitant prices, but there is often no reason why the man who wishes to finish his house in mahogany should not buy the lumber and have his carpenter work it as he would cherry, walnut, or oak.

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THE AMERICAN MAMMOTH (ELEPHAS PRIMIGENIUS).

BY DR. J. B. HOLDER, AMERICAN MUSEUM OF NATURAL HISTORY, CENTRAL PARK.

By the term American mammoth we do not intend to indicate a difference between the remarkable fossil remains which we here exhibit and those so long notable as the Siberian mammoth. It is simply to point out that in America the fossil remains of mammoths—so called conventionally—have been found, and more particularly to announce the fact that an extraordinary "find" has lately been made, which well nigh amounts to a first discovery of the species, so far as anything like an adequate amount of remains had hitherto been found on this continent. Teeth and small fragments of the bones of elephants have been found at various times, and in widely separated regions of this country. Now we have the skeleton, its several parts so nearly entire as to warrant their artificial articulation as a complete mounting. For this we are indebted to Dr. Edmund Andrews, president of the Chicago Academy of Sciences.

Through the kindly offices of Dr. Andrews and Dr. Velie, I am able to present a complete account and drawing of this valuable and well nigh unique example of one of the greatest of fossil mammals.

Dr. Andrews had learned some years since of the existence of this series of bones, and kept in view the purpose of possessing them. The enormous price which such an unusual "find" naturally suggested was finally reduced to a reasonable amount, when the Doctor arranged to purchase the bones and to present them to the Chicago Academy. The result is that that institution possesses the second example of the great creature, which also possesses the advantage for science of being from a widely distant locality—even from another continent.

Members of the "Mastodon Club" assisted Dr. Andrews in bearing the expense.

The remains of this mammoth were discovered in the spring of 1878, in the southwest part of Spokan County, in Washington Territory. The country is a rolling prairie, about 2,000 feet above the sea, extending from the Rocky Mountains to the Cascade Range. The immediate locality where the bones were discovered is on Hangman's Creek, which runs into the Spokan River, a tributary of the Columbia. So near the surface were these remains, they were first exposed through the operation of ditching the land for agricultural purposes. Remains of four mammoths were here disinterred in a marshy hollow, which is formed by a spring oozing from a black mud—the frequently seen conditions attending the remains of the mastodon.

A very perfect skeleton of a smaller animal, described by one who saw it as "the bones of a horse," was found in close contact with the mammoths. The same conditions which apparently existed when the elephants here perished now occasionally cause the fatal miring of cattle.

Besides the remains of four elephants, there was found a pelvis of a fœtal proboscidian, which probably perished with its own.

Some of the measurements taken from the more perfect skeleton are as follows: Length of tusks, 9 ft. 10 in.; circumference of tusk at base, 21 in.; length of molars in mandible, 10 in.; length of lower jaw, or mandible, 22 in.; height of pelvis, 34 in.; breadth of pelvis, 62 in.; length of humerus, 45 in.

The height of this elephant's skeleton, as now mounted, is given as 13 ft.; and the measurement of the Siberian example at St. Petersburg is also given in the Chicago Academy's bulletin as 9 ft. 3 in.

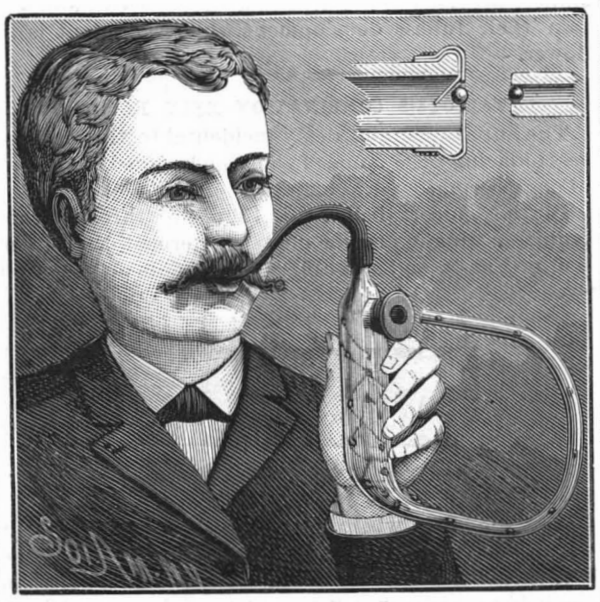
The present example is mounted with the limbs too much in a line, which gives greater height; but, allowing for the loss of certain integuments which in life contribute materially to give height, this creature must have been something over 12 ft. in height, if not quite 13. Jumbo's height is given at 11 ft. 2 in.

In a very exhaustive treatise on the elephant race, called the "Ivory King," Chas. Scribner's Sons publishers, some reliable figures are given, which determine the extreme measurements of the largest elephants known.

Some measurements are there given of the notable Hauser elephant, in the Medical College of Chicago. It is the Indian species, which does not reach the great height of the African one, though the present example in the skeleton seems to present the same dimensions in height as that of Jumbo—11 ft. 2 in.

An African elephant measured by Thomas Baines, F.R.G.S., was in height, at shoulder, 10 ft. and 9 in., and 12 ft. at the highest portion of the dorsal region. These figures are very exceptional. Elephants of 8 ft. are large, and no examples are on record exceeding in dimensions those we have mentioned.

Great discrepancy exists in the statements of the size of the tusks of elephants. The largest example we have seen is that of the Messrs. Grote & Co., of 14th Street, New York. It stands at their door as a sign,



EXPERIMENTAL ILLUSTRATION OF THE INJECTOR.

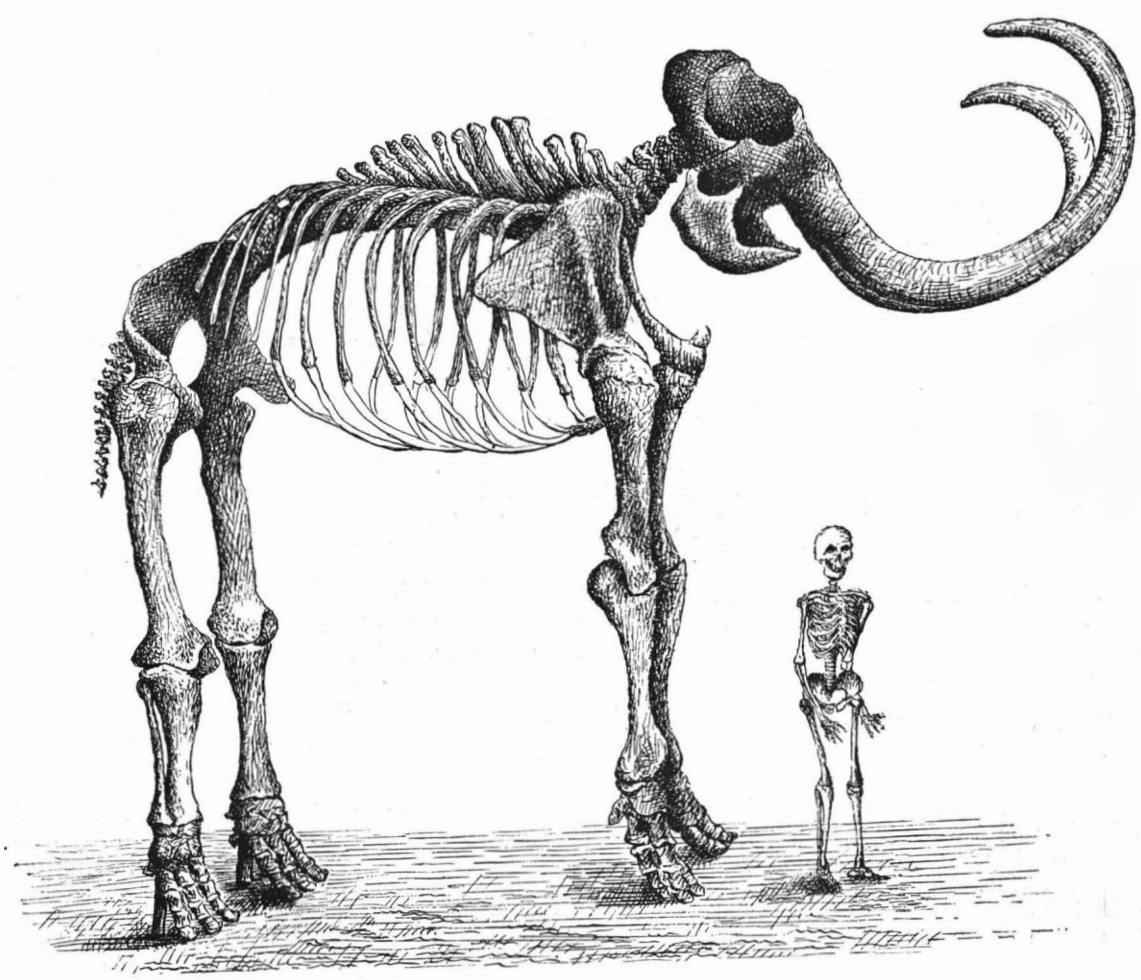
and is from the African species. Its length on the outside curve is 8 ft. 11 in.; the diameter at base is 6½ in.; its weight, 184 pounds.

The Messrs. Totans & Schmidt, of Fulton Street, have a superb pair, the largest being but 5 in. shorter than the latter. These are extraordinary examples.

It will be noticed that the mastodon and fossil elephants' tusks are not much longer, but they have a wide divergence and curve upward (though one example is recorded as measuring 12 ft. 6 in.), which gives them a peculiar or unusual aspect.

The forearm, or humerus, of the subject of our text is given as 45 in. in length. The extraordinary dimensions of this skeleton may be appreciated by noting the relative difference between it and the adult human which stands in front.

Dana, the geologist, states that this species of "ancient elephant was over twice the weight of the largest modern elephant, and nearly a third larger. The body was covered by a reddish wool and long black hair. One of the tusks measured 12 ft. 6 in. in length. It was curved nearly into a circle, though a little obliquely. . . . At the mouth of the Lena one of these animals was found which measured 1[illegible] ft. 4 in. in length, exclusive of the tusks. Its height was 9 ft. 4 in. It retained the wool on its hide, and was so perfectly preserved in the ice that its flesh was eaten by wolves or dogs."



THE AMERICAN MAMMOTH (ELEPHAS PRIMIGENIUS).

EXPERIMENTAL ILLUSTRATION OF THE INJECTOR.

T. O'CONOR SLOANE, PH.D.

The injector used for feeding boilers with water has puzzled many who could not see in it anything but the analogue of the impossible feat of blowing into one's own mouth. The principle on which it works is, however, quite simple. By the condensation of steam issuing from a boiler, and by its mechanical action, a high velocity is imparted to a jet of water. The momentum thus developed is sufficient to drive the water into the same boiler against a pressure equal to or exceeding that of the actuating steam. The principle can be carried still further. Steam from a boiler at low pressure can be made to force water into a boiler at high pressure.

The apparatus illustrated in the cut shows the principle of momentum applied to a great extent, as in the steam injector. A strong pressure of air is maintained in a receptacle representing a boiler. A small injector tube is provided for a blast of air which escapes from the reservoir. The blast is made to operate as a feeder, driving lead shot into the reservoir against any pressure that can be maintained within it.

The apparatus as shown is made of glass. The large reservoir represents a boiler. This should be an inch in diameter and four or five inches long. At its top it is provided with a reduced nozzle, to which an India rubber tube can be attached. The pressure is produced within it by blowing into this tube.

From its bottom a tube is carried outward, then curving upward with a very smooth curve, and finally is retracted so as to point horizontally toward the upper portion of the larger tube. This injector tube must be of strong or heavy glass, and its inner surface must be true and free from irregularities. It may be of such size as to receive B B drop shot. This size will require a good deal of air to keep the apparatus working, and a smaller size is nearly as effective and less exhausting to the experimenter. A tube $\frac{1}{16}$ inch in diameter is sufficiently large. The shot fitting it, though but half the diameter of B B shot, will work perfectly. Near the top of the large tube and directly opposite the open end of the injector tube a neck projects laterally from a point below the shoulder. This should be half an inch or more in diameter. It is provided with a valve. A disk of soft leather, such as a piece of a kid glove, is stretched over the opening of this neck. A little above its center a small hole is made, about twice the diameter of the shot it is proposed to use. Underneath the kid a flap of India rubber cloth or packing is secured, forming the clapper of a valve. The India rubber cloth must have some thickness, so as to be stiff and preserve its shape under the bombardment it is to be subjected to. The hole in the leather, representing the valve opening, must be directly opposite the end of the small glass tube. The leather and India rubber are tied over the neck, as shown in the section.

Half a dozen pellets of shot are dropped into the apparatus. They must first be poured or rolled through the outlet tube to see that they move with perfect freedom. If they show the least disposition to stick or catch in the tube, smaller ones must be used. If all is right, the apparatus is held as shown in the illustration, and the experimenter blows into the apparatus as hard as possible.

The only outlet for the air is the small eduction tube. The air rushes out of this, carrying the shot with it. They pass through it with accelerated velocity, and acquire a very high speed before leaving. As they are driven out of the open end they impinge upon the valve, and, forcing it open against the air pressure, drop into the reservoir. They fall down to its bottom, flying around its walls in spiral paths, only to be again and again expelled through the outlet tube. The noise made as they strike against the tense rubber valve is very peculiar. The rapidly repeated sounds resemble the discharge of a miniature Gatling gun. If all is rightly arranged, the operation can be kept up indefinitely, or as long as the experimenter can supply

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air. To prevent the shot from catching in the valve, the opening should be above the center of the diaphragm. The position of the opening depends on that of the outlet or injector tube, so that in making it care must be taken to have this tube point to the right place.

The apparatus illustrates very well the principle of the injector. The loss of air represents, besides waste, the condensation of steam that is the actuating force in the injector. Were it worth while, there would be no trouble in carrying out, on a similar plan, the experiment of causing a blast of air of low pressure to drive shot into a vessel of air of much higher pressure.

Natural History Notes.

Diseases of Animals.—According to Dr. J. B. Sutton, animals are not free from certain diseases thought to be referable in man to his erect position. One-fourth of the female monkeys that die in the London Zoological Gardens have displacement of the uterus, and the same disease occurs in the lioness, tapir, Cape hunting dog, pygmy hog, antelope, etc., and in domesticated mammals. Two cases of inguinal hernia in monkeys are recorded, and the disease is said to be common in horses.

Modification of Habits in Ants through Fear of Enemies.—Dr. H. C. McCook gives an account of an unsuccessful raid which he witnessed of *Formica sanguinea* on a nest of *F. fusca.* The instinct for kidnapping has appeared to develop, on the part of those that are the victims, a corresponding strengthening of instinct in the way of concealment. When the latter are not exposed to the acts of the former, they raise above the surface of the ground a mound of more or less considerable size, and over its summit and at the base the gates are scattered without the least attempt at concealment. But when a colony of their enemy is near, they omit or diminish elevations above the surface, their gates are few and cunningly concealed, and quantities of rubbish are scattered around, with the evident intention of hiding the locality of their nest or making the approach to it more difficult. A similar faculty has been observed in *Formica schaufussi.*

Action of the Ultra-Violet Rays in the Formation of Flowers.—Prof. J. Sachs gives details of the experiments from which he has come to the conclusion that the ultra-violet and invisible rays of the solar spectrum are especially efficacious in the development of flowers. The experiments were all made upon the nasturtium (*Tropœolum majus*). If the rays of the sun are made to pass through a solution of sulphate of quinine, the ultra-violet rays are entirely absorbed or transformed into rays of less refrangibility, and which are visible and of a light blue color. If a plant is made to grow behind a screen of sulphate of quinine, the vegetative organs are normally and luxuriantly developed, but the flowers are almost entirely suppressed. Twenty-six plants thus grown produced only a single feeble flower, while twenty-six plants grown under similar conditions behind a screen of water of the same thickness produced fifty-six flowers.

Prof. Sachs believes that extremely small quantities of one or more substances formed in the leaves cause the formative materials which are conveyed to the growing points to take the form of flowers. Acting like ferments, an extremely small quantity of these flower-forming principles may act upon large quantities of plastic substances. It may be assumed, then, that there are three distinct regions of the solar spectrum, differing in their physiological action: the yellow rays and those near them cause the decomposition of carbonic dioxide, and are active in assimilation; the visible violet and the blue rays are the agents in movements of irritation; and the ultra-violet rays are those which produce in the green leaves the substances out of which the flowers are developed.

Sheaths of Algæ.—Some important observations have recently been made on the substance of which the sheath that invests the filaments of some algæ is composed. Herr G. Klebs maintains that it is not formed from the cell wall, but from the contents of the cell, through the cell wall. The sheath substance differs from the ordinary mucilage in not being dissolved by alkalies.

Rabbits in Australia.—Australia is overrun with rabbits, and vigorous measures are now making to reduce their numbers. Notwithstanding that eighteen millions of these animals have been destroyed in less than three years, their number is still so great that sheep can find nothing to browse upon and are obliged to abandon their fields before this invasion. In the colony of Victoria, the government has already spent 24,000 pounds sterling for the destruction of the pest, and private initiative has devoted no less than 15,000 pounds in similar efforts. Land that formerly sold at high figures can now be bought for 10 shillings per acre. More than twelve million acres are overrun, and where, in 1875, 700,000 sheep were raised, no more than 100,000 are now raised. This represents an annual loss of about 480,000,000 pounds sterling.

Root Buds.—One of the distinctions between roots and stems was formerly stated to be the appearance of leaf buds on the latter and their absence from the former. The *Gardeners' Chronicle* illustrates the formation of leaf buds on the fibrous roots of a fern (*Diplazium malabaricum*) and suggests that it will ultimately be found that buds and sporangia of all kinds are variants from a common type.

Tubercles on the Roots of the Leguminosæ.—Mr. H. M. Ward finds that the tubercles on the roots of leguminous plants are due to a parasitic fungus. He claims to have found the infecting agent and to have produced the tubercles by infection from without. When the tubercles decay, the germ like bodies pass into the soil and infect other roots. On the other hand, Mr. Tschirsh maintains that these tubercular bodies are the natural storage organs for nitrogenous substances previous to the ripening of the seeds, and attain their fullest development while the plant is in flower.

TALCOTT'S COMBINATION BELT HOOKS.

The annoyance and delay incidental to the old process of lacing belts is one of the time-honored traditions of engineering.

In the Talcott belt hook there are three rows of points—a single row on one side, termed the clinch points (Fig. 1), and a double row of points on the other

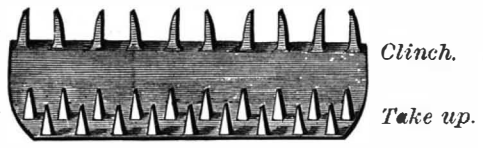

Fig. 1.—TALCOTT'S BELT HOOK.

side of the hook, which hold in the belt by wedging it against each other, and they are not as long as the belt is thick. But the clinch points, being longer than the belt is thick, are riveted down as shown in Fig. 2.

Whenever the belt becomes slack and requires to be shortened, it can be pulled away from the double row of points, marked "take up," and, after cutting to the right length, the belt can be quickly replaced on the same points. The fastener is light and narrow and the edges rounded and beveled, so they will be perfectly smooth when the belts are slipped by hand. This belt

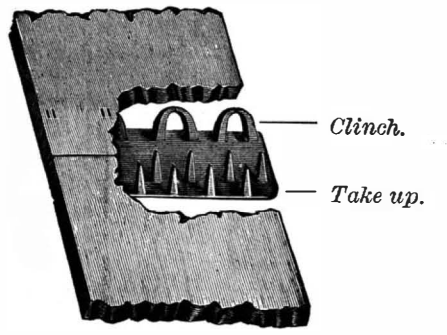

Fig. 2.—AS APPLIED TO BELT.

hook is extensively used and gives much satisfaction. W. O. Talcott, of Providence, R. I., sole manufacturer, will send samples free.

Progress in Telephony.

Few inventions of modern times took the public more by surprise than did the telephone, a result due not more to the marvelousness of the thing done—namely, the transmission of spoken words along a telegraph wire—than to the simplicity of the means by which it was accomplished. Seldom, also, has an invention given rise so soon to an important industry. Five years ago the telephone was being viewed by the *savants* of the British Association with the interest attaching to the very latest novelty in scientific toys. It is now employing in the United Kingdom alone more than ten millions of capital, and earning over $750,000 in dividends. The practical instrument of to-day, however, differs considerably from the scientific toy patented by Professor Bell.

For communicating over short distances, as between the various parts of a house, or between neighboring premises, the original Bell telephone is a sufficiently satisfactory instrument. Its currents, however, are too feeble for telegraphic circuits of any considerable length. Modifications have been made, with the view of adding to the volume of sound. Edison was the first to effect this, by causing the diaphragm spoken against to press upon a carbon button; and Professor Hughes carried the use of carbon still further in his invention of the microphone. By the employment of the latter, the lowest whisper was found to be loudly reproduced in the telephone.

The original Bell receiver has been but slightly modified, with the result, however, of giving increased loudness. It is now the opinion of competent electricians that the telephone, as a speaking instrument, is well nigh perfect, and that the difficulty of making it practically useful under all circumstances is almost wholly due to disturbing external influences.

A hundred miles is as yet the maximum distance through which speech, or indeed any definite sound, has been transmitted by submarine cable. The chief practical difficulties in working the telephone are due to the fact that when an electric current is passing along a wire it has the property of producing a current of opposite character in any wire in its vicinity. This is what is known as induction, and it is owing to this faculty that the words spoken on one wire can be overheard on an adjoining one. If the neighboring wire should be telegraphic, the feeble current of the telephone is overpowered by its stronger neighbor, and it is difficult, if not impossible, to catch the transmitted words amid the din—compared to the noise of a pot boiling—caused by the telegraph. Still more fatal to all telephonic communication is the presence of an electric lighting system in the vicinity of telephone wires, the powerful current necessary for lighting purposes causing "an incessant roar that renders speech an impossibility." Many plans have been tried for overcoming the unpleasant consequences of induction, the most successful of these being that of using an additional return wire instead of utilizing the earth for the completion of the circuit. The two wires are placed in close proximity, with the result that the disturbing influence is completely neutralized.

In no direction has telephony progressed more than in the extent to which it has been adopted as a convenient mode of communication. Already the telephone exchange system is being worked in almost all the principal cities and towns of Europe and America. Paris has its central exchange, with nearly a thousand wires converging upon, besides several branch exchanges connected with, the central one. The Parisians avoid the unsightliness and danger of a great network of overground wires by placing the telephone wires in the sewers. In Belgium there are not only exchanges for telephonic communication within the towns, but those of different localities are connected by trunk lines, a much wider area of intercommunication being thus established. Nowhere is the system better organized than in Berlin, where there are four exchanges, besides two public telephone offices, in which any person, on payment of sixpence, is permitted to have five minutes' conversation with any one whose house is connected with the central office. The Berlin Bourse is also provided with nine chambers, in which the necessary quiet for holding telephonic communication is obtained by the thick padding of the chamber walls. The telephone industry has, however, made the greatest progress in the land of its birth, there being telephone exchanges in at least 860 towns in the United States. In New York alone there are exchanges with over 7,000 subscribers, besides 2,500 private telephone wires.—*Extract from Iron and Steel Trades Journal.*

Fatal Encounter with Sharks.

James E. Hamilton, the mail carrier between Miami and Lake Worth, on the South Atlantic coast, was devoured by man eaters at Hillsboro Inlet, on October 18. He was a stout, athletic young man, and carried the mail between the two places, a distance of seventy-five miles, on his back, walking on the beach most of the way. The inlet is a dangerous crossing, the back waters of the Everglades meeting the tides and producing heavy and dangerous seas. Sharks of the most ravenous kind abound there. An old fisherman named Waring, who was within half a mile of Hamilton when he began crossing, describes the tragedy as a horrible occurrence. When Hamilton reached the middle of the inlet the sharks flocked about his boat, leaping ten feet or more out of the water in their eagerness to get at human flesh.

Hamilton fought them with his oars, but soon both were bitten off and dashed out of his hands. Then they assailed the boat, tearing huge pieces off the gunwale. Soon it began to sink, and Hamilton became stupefied with fear. Another blow on the frail boat, and he was thrown headlong into the masses of fierce sea wolves. One shriek of agony, and all was over. The sea was dyed for yards around with his life blood. Searching parties were sent out, but nothing was found. Hamilton's death was such a horrible one that no mail carrier over that route has yet been secured.

Agglomerate Leclanches.

MM. Bender and Francken give the following recipe for making agglomerate Leclanche cells:

	Per cent.
Manganese peroxide	40
Graphite	44
Gas tar	9
Sulphur	0·6
Water	6·4

These substances, says the *Revue Scientifique*, are reduced to a fine powder—gas tar and water apparently included—they are then carefully mixed, placed in a mould, and strongly compressed. The mixture is then gradually raised to a temperature of 350° C., which not only evaporates the water, but also drives off the volatile elements of the gas tar. This result is aided by the presence of the sulphur. A portion of the sulphur combines with the gases derived from the tar and disappears, while the remainder is said to combine with the solid ingredients, producing an unassailable compound, by a transformation analogous to that of the vulcanization of India rubber.

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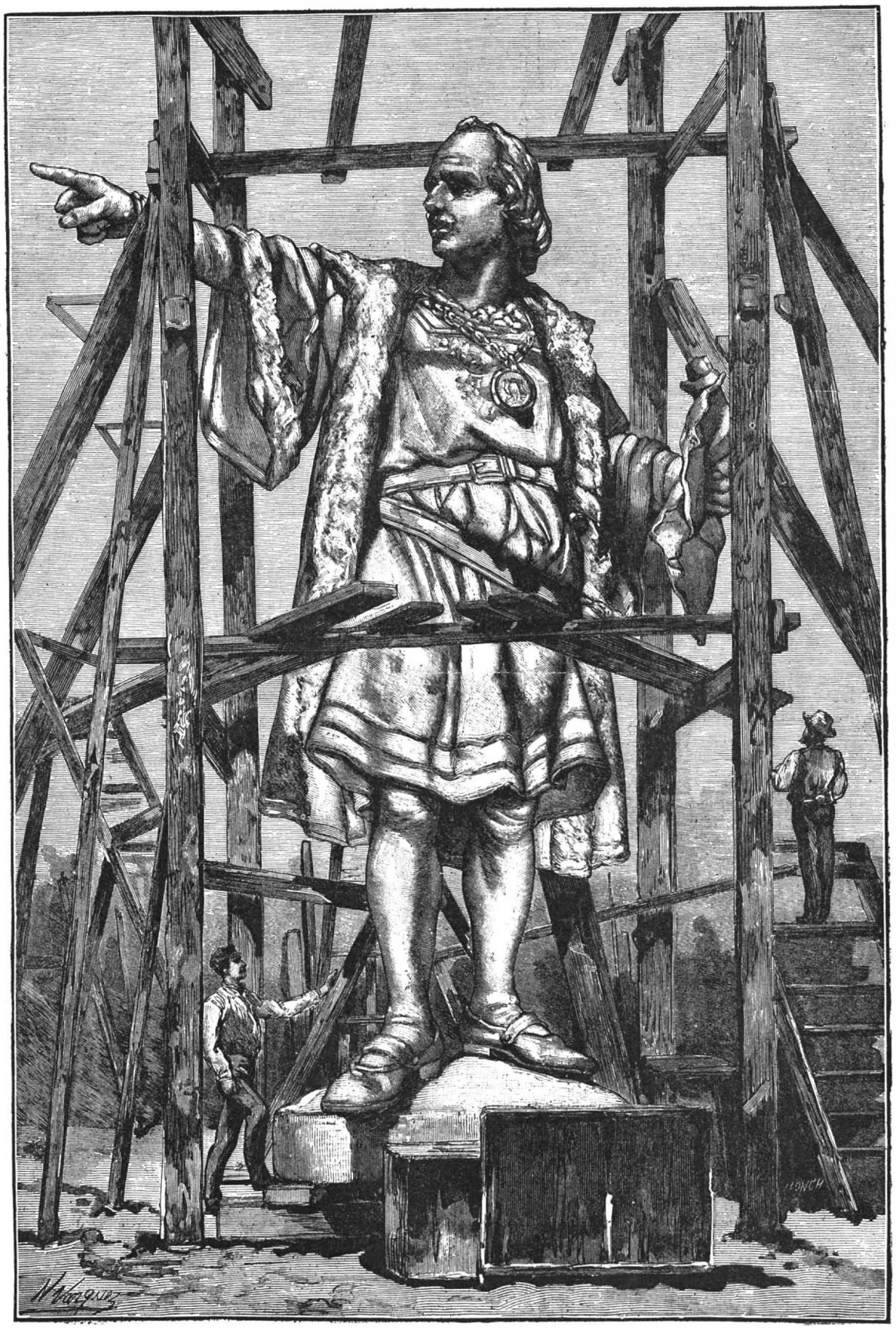
THE STATUE OF CHRISTOPHER COLUMBUS AT BARCELONA, SPAIN.

On Friday, October 12, 1492, the land of the western hemisphere was first sighted from the fleet of Columbus. The night before, Columbus had discerned a light, and in the award of the gift of money and other favors by the crown of Spain to him who first saw land, the prize was adjudged to belong to the great admiral. In a few years the fourth centennial of the discovery of America will be at hand. America, Italy, and Spain may then join in the celebration of the deed of the great Italian sailor.

On April 3, 1493, Columbus embarked from Barcelona to carry to the monarchs of the world the news of his achievement. This city, one of the most active and enterprising in Spain, has been unwilling to lose even this small share in the glory of Columbus. In his second voyage, the admiral was accompanied by a number of Catalonians, the Treasurer Santangel, *El Capitano* Margarit, Fra Bernardo Boyl, first patriarch of the Indies, and twelve missionaries from Monserrat. These too the City of Earls, as Barcelona has been entitled, does not desire to leave unremembered. The city erects, therefore, a magnificent memorial to Columbus and the Catalonians who assisted him. It includes a memorial landing * and a colossal statue. The latter we here illustrate. For it we are indebted to our contemporary, *La Ilustracion*. We may first say a few words of the memorial landing.

In September, 1881, a national competition for designs for a memorial to Columbus was opened under the auspices of the city of Barcelona. The central executive unanimously accepted the plans of the architect Don Cayetano Buigas Monraba. A great plaza on the water's edge is provided with several flights of wide steps descending to the sea. Toward each side of the terrace are carried out two extensions, in the somewhat conventional shape of bows of vessels of the fifteenth century, designed to recall the two undecked caravels of the original fleet, the Pinta and Nina. By balustrades of rich design, and by statuary, the landing is still further ornamented, and it is flanked by two lights upon advanced points.

The statue of Columbus is also by a Spanish artist, D. Rafael Atché. It is of colossal size, being 20 feet in altitude. The spirited engraving gives a good idea of the vigor and animation of the design. With intent and piercing gaze, the discoverer can be imagined pointing into the West, the goal of his pilgrimage, and toward the land of whose existence he had so little idea. The figure carries with it the idea of a human being through all the drapery encircling it. This alone is a tribute to its excellence, as such figures so often appear but sculptured clothing. But here it is not too much to say that through all the accessories the representation of the living, breathing life of the man is discernible, and we can conjure to ourselves that the distant light on the American island is pictured on his retina and telling him that the end of his voyage is near.



STATUE OF CHRISTOPHER COLUMBUS, IN BARCELONA.

IN a communication to *L'Electricien*, Captain F. Pescetto points out that a copper lightning conductor will protect a larger area than an iron one of equal resistance will do, since the self-induction of iron is very much greater than that of copper.

* See SCIENTIFIC AMERICAN SUPPLEMENT, No. 401.

Gait of Criminals.

A curious study has been made by Dr. Peracchia of the differences between criminals and law-abiding citizens as exhibited by their walk (La Riforma Medica, No. 147, 1887). The author first made a number of observations to determine the conditions of normal progression, and found that in good people the right pace is longer than the left, the lateral separation of the right foot from the median line is less than that of the left, and the angle of deviation of the axis of the foot from a straight line is greater on the right side than on the left. But this is not all. Dr. Peracchia has not only shown us how we may distinguish criminals in general, but has laid the beginnings of the differential diagnosis between various sorts of evil-doers. The following are the distinguishing characteristics which his observations have enabled him to formulate:

1. *Thieves.*—In those who are predisposed to appropriate the property of others, there is a pronounced widening of the base of support, together with a very long step.

2. *Assassins.*—In those who have murder in their hearts, the base of support is not as wide as it is in thieves, since the angle formed by the axis of the foot with the median line is less obtuse, but the sinistrality betrayed by their footprints is very marked.

These discoveries are of a very interesting character, and the *American Analyst* suggests that if the criminal could be induced to walk before the honest man, instead of following him as he usually does, they might also be put to a practical use, for then good citizens could diagnose the rogue by his tracks, and might thus be enabled to escape robbery or assassination, as the case might be.

American Mechanics.

The following is an extract from an article by Prof. Dieffenbach, in illustration of what he acknowledges to be a fact—that American mechanics placed side by side with European artisans, the former show in a very short time their superiority. It is a manly confession of what is very generally known by every impartial observer. We give the extract in the Professor's own words: "More surprising still is the influence of North America upon handicrafts, and especially on the whole domain of mechanical technology. Here there is still a very wide difference between Germany and the United States. While our chemical technology has been distinguished by extraordinary advances, in consequence of which our chemical manufactures have recently conquered a multitude of new markets, our mechanical technology has not developed at the same rate. What an American workman is able to accomplish by means of these tools may be seen by an example.

"The writer of this article spent a portion of 1878 and 1879 in Leipzig, where he became acquainted with a manufacturer of boots and shoes. One day an American applied for work. He stated that he had come to Germany on account of his son, who had a talent for music, and whom he wished to have educated at the conservatory. He said he was looking for work in order to pay his son's expenses, and he desired to use the tools that he had brought over from America. The manufacturer agreed. Now, the American appeared at his place daily, looked neither to the right nor to the left, but attended to his work to the last stroke of the bell. The manufacturer soon noticed that he had obtained a man fully equal to the German hands in thoroughness and skill, and capable of turning out three or four times as much as any other, thanks to his exemplary diligence and his American tools. Wages being paid by the piece, the man earned more than enough to support himself and his son."

Doing Repairs in a Hurry.

The *Manufacturers' Gazette* is quite right in its assertion that lack of judgment causes more trouble in a machine shop than anything else. It is liable at all times to make trouble for the workman, the foreman, and the customer alike. This is particularly noticeable on repair work which comes in a hurry and is wanted in a bigger hurry. There is no time for the foreman to think what is best to do under the circumstances. The customer comes with the job and wants to take it right back again, no matter if the services of moulder, forger, and machinist combined are required. He asks Mr. Foreman how soon the job will be finished, and probably induces the foreman to cut the time down one-half. The customer is back when the stipulated time arrives, if not before, and stays until the job is done, follows him all over the shop, hangs over the job, makes the workmen fidgety asking questions and making suggestions, besides having the foreman chase up the workmen. He finally gets the job done, and thanks his stars that he stayed at the shop, for he is sure that if he had not, the job would have taken twice as long.

The result of such personal overseeing is, in nine cases out of ten, that the job has taken at least twenty-five per cent more time, because the majority of machinists get nervous while a stranger is standing watching them, and lose their head, and the consequence is not only time, but quality of workmanship, is lost.

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ENGINEERING INVENTIONS.

A car coupling has been patented by Messrs. Jonas Potter and John W. and William M. Hess, of Morrellville, Pa. It is of simple construction, and designed to couple with an opposing coupler of greater or less height, being so constructed that the coupling pin may be held out of engagement with the link when it is desired to shunt a car by bumping or to drive a car forward or back on the track.

AGRICULTURAL INVENTIONS.

A check row planter has been patented by Mr. James Dunkin, of Bridgeport, West Va. It is designed to plant corn or other seed in straight rows both ways by a system of marking which shall be easily discernible, and embodies an arrangement of dropping devices for depositing at the same time a quantity of fertilizer.

A combined cultivator, harrow, and seeder has been patented by Mr. Dalton Walls, of Appleton, Wis. This invention relates to a former patented invention of the same inventor, and provides a seeder attachment, a lateral adjustment of the axle and forward supporting bar, and the adjustment of the seat and shovel beams, with other novel features.

A plow has been patented by Mr. George Wolverton, of Charles City, Iowa. The plow is of that class whose beams are pivotally secured to the standard and adapted for adjustment vertically to vary the depth of the furrow, the standard being forked at its upper end, the beam resting between the forked ends upon a bolt passing through them, and the construction being light, strong, and inexpensive.

A hay loading machine has been patented by Messrs. Matthew H. and Leroy Arnold, Edward P. Mitchell and Ruben F. Taliaferro, of Hueneme, Cal. A rake is supported at the front end of a truck which has a vertical fixed post, there being a bar with a universal and permanent connection with the back of the rake and the lower end of the post, with mechanism for raising the rake and outer end of the bar and swinging them outward, with other novel features.

MISCELLANEOUS INVENTIONS.

A reversible car seat has been patented by Mr. John M. Sauder, of Harrisburg, Pa. It has a united seat and back supported on a base, with arms pivoted on the base and connected with a head, forming a universal joint with a plate on the bottom of the seat.

A mattress protector has been patented by Mr. Duncan W. McKinnon, of North Sydney, Nova Scotia, Canada. It consists of a pointed tube adapted to penetrate and pass through the mattress, in connection with a waterproof blanket with which the tube is connected.

A folding vehicle seat has been patented by Messrs. Samuel and George Penfold, of Guelph, Ontario, Canada. It is so made and mounted that it may be used in connection with the vehicle body either as a single or a double seat, and so the body will appear in proportion with the seat used in either form.

An animal trap has been patented by Mr. John W. Jones, of New York City. It is a trap in which decoys are used in the bait chamber, closed by a glass in front, and provided with a mirror to reflect the decoys, a separate trap chamber being provided to catch the animal.

A game trap has been patented by Mr. Tony Alexander, of Bogue Chitto, Miss. It is a device by which animals passing over the trap are caught around the body or neck without injuring their fur, the invention covering various novel features of construction and combinations of parts.

An animal trap has likewise been patented by the same inventor, containing somewhat similar features, the invention consisting of hinged catches adapted to engage jaws or prongs, a platform being pivoted on the catches and resting against the sides of the jaws when the catches engage the latter, the trigger operating with great ease and certainty.

A rubber boot has been patented by Mr. James F. Shaw, of Jackson, Mich. It has an opening in its instep covered by a flap, with means for holding the flap firmly against the leg of the boot to adjust the opening, so that rubber boots thus made can be readily drawn on over other boots made of felt or knit fabrics, etc.

A breech loading fire arm has been patented by Mr. Wilhelm Sonnenberg, of Winona, Minn. It has a device for locking the barrel on and unlocking it from the stock, means for setting the hammers and triggers when opening the barrel, and a device for locking the triggers automatically by the device for locking the barrel on or unlocking it from the stock.

A gate has been patented by Messrs. Edward R. and Solomon C. Chase, of Findlay, Ohio. It is adapted to slide sidewise, and has a slotted lever connected with it, with arms near its fulcrum, a spring lever, and other novel features, whereby the gate may be opened or closed from either side, and may be operated by a person in a vehicle.

A flood fence has been patented by Mr. Henry D. Merrill, of Columbus, Ind. It consists of posts fixed in the bed of the stream, with curved plates having stops arms attached to them, and a log or beam carrying pickets suspended from the posts, the end pickets engaging the stop arms, with other novel features.

A can washer has been patented by Mr. Sylvanus Roberts, of Chester, N. Y. It is an improved device for washing milk cans inside and out, consisting of a box with adjustable lid carrying brushes on its inner face to engage the outer surface of the can, and an expansible frame with brushes for insertion in the can, with other novel features.

An inkstand has been patented by Mr. John Hoey, of New York City. It has a cover which swings from a pivot above the ink well, a hand piece being connected to the cover in front of the well, so that the act of dipping the pen will swing the cover back from over the well, the cover dropping of its own weight to close the well when the hand is removed.

A trace carrier has been patented by Mr. Austin McNally, of Cascade, Iowa. It has a block of soft India rubber fitted in its crown and projecting down between the prongs on which the cock eyes are placed, the prongs being slightly curved toward the center of the holder, so the rubber will hold them and there will be no danger of their casual detachment.

A knockdown box has been patented by Mr. John Hotham, of Hillside, Pa. It has a main body composed of sheet metal side pieces and sheet metal end pieces hinged together, the top and bottom being united to the edges by flanges in such way that they can be readily removed, when the body will collapse and the whole can be shipped flat.

A dish for table use has been patented by Messrs. James M. Sanders and William A. Stamats, of Morrisville, Ohio. It has a bowl portion and side wings or flanges of concave form, with a back wing, flange or receptacle, making a dish with various receptacles, whereby one dish will answer for a variety of purposes.

An overshoe has been patented by Messrs. Michael M. Clark and Peter McKernan, of Shenandoah, Pa. It has a stamped sheet metal bottom, with flange, and a stamped sheet metal heel, combined with a metal top sole, a leather upper and heel part being secured to the flange of the sole and the upper edge of the metal heel.

A seal lock has been patented by Mr. Amos Standing, of Duquoin, Ill. Combined with an apertured front plate and a slotted sliding bolt is a fragile seal fitting in the slot of the bolt and a lock device engaging the upper edge of the seal, with other novel features, the construction being simple and durable.

A dump cart has been patented by Mr. Thomas J. Flanigan, of Butte City, Montana Ter. It is especially applicable for the carting of minerals and stones, being so constructed that such materials will not wear away the parts as they are being carted or dumped, the invention covering various novel details of construction.

An indexed book has been patented by Frank Rosewater, of Cleveland, Ohio. It has at its opening edge a series of tags in oblique rows, each row representing a section of pages, and the inner edge of the cover has a series of subdivisions indicating by their position the fractional part of the space between the rows of tags.

A bustle has been patented by Mr. Cecil M. Durnil, of Fayette, Mo. It is made of adjustable bows hinged to a main wire formed with top and bottom curved wires, so that it may be adjusted both as to width and depth and attached to the body at or below the waist, closing up to the body under pressure and afterward assuming its designed proper shape.

An improvement in hames and rings therefor has been patented by Mr. Thomas S. Alexander, of Meriden, Conn. A section of the hame is provided with a shouldered post adapted to receive or carry the hame ring or terret, which has an aperture through which the post passes, so that the rings can be readily attached or detached.

An improvement in drawing instruments, calipers, etc., has been patented by Mr. Frank Miller, of New York City. The arms or jaws extended to form the working points are screw-threaded on opposite converging surfaces, in combination with an internally screw-threaded nut, to provide for a more convenient and accurate adjustment of the jaws or members to and from each other.

An automatic fire extinguisher and sprinkler has been patented by Mr. James H. Lynde, of Manchester, Lancaster County, England. It has a fusible seal and a seal-protecting composition of paraffine and barium between the water space and the seal, to prevent leakage while the solder is fusing, and insure complete separation of the joint before any water from the supply pipe is permitted to reach it.

A hand rock drill has been patented by Mr. August J. Becker, of Mount Carmel, Pa. It consists of a cutting tool having a shank fitting into the hollow shank of the holder, an annular lug or lugs being formed on the cutting tool, and fitting into corresponding recesses on the lower end of the shank of the holder, making a cutting tool that can be readily removed to facilitate grinding.

A washing machine has been patented by Mr. Seth W. Warren, of Olean, N. Y. The tub has at its sides guide strips and at its ends curved strips, in connection with a rubber, the body of which is curved in the arc of a circle, with rows of cells and upwardly opening valves on its under side, whereby the water is repeatedly forced through the fabrics, and the rubber has a combined rocking and reciprocating motion.

A cork fastener has been patented by Mr. Charles Von der Linden, of Rhinebeck, N. Y. It consists of two plates of metal, each bent twice at right angles in the same direction, forming long and short arms, the longer arms being pivotally connected by a rivet and the shorter arms having their extremities concaved to fit them to the neck of a bottle, making a binder fitting over the cork and under a flange in the neck of the bottle.

Feathering blades of paddle and other wheels form the subject of a patent issued to Mr. Amos H. Carpenter, of Stockton, Cal. Blade arms are journaled at their centers in transverse apertures of the main shaft, longitudinal movement being prevented by collars, there being rings on the shaft having cam surfaces which operate rods connected with a crank or lever attached to each blade arm, with other novel features.

A pitman or pump rod has been patented by Mr. John F. Loomis, of Shelby, Iowa. Combined with two sections of the rod are right-angular springs, clamps and spacing blocks being arranged between the portions of the springs at right angles to the rod, with other novel features, the invention being an improvement on a former patented invention of the same inventor, to make such rods elastic for taking up strains and jars.

A shade or globe holder has been patented by Mr. William J. Stratton, of Brooklyn, N. Y. It has a central ring with three or more outwardly extending arms, the arms bent to form shoulders, below which they extend downward in substantially vertical lines, the end of each of the vertical sections carrying a centrally apertured and internally threaded block, there being screws within the blocks which serve as the direct supports of the globe.

A dump cart has been patented by Mr. Frederic H. Evans, of Brooklyn, N. Y. The cart bodies have trunnions supported in bearings mounted to the rear and above the axle of the cart, the use of the crank axle being avoided, and also the necessity of adjusting and removing a tail board, while there is no rush and jar of the cart body, and the invention is applicable to a four-wheeled vehicle as well as to one of two wheels.

A combined shaping and sawing machine has been patented by Mr. William Huey, of Seaford, Del. This invention covers a novel construction and arrangement of parts in a machine which will at one operation cut off and saw out a round disk from a block or bolt of wood, to form the bottom of a fruit basket or measure, or the head of a keg or barrel, and will also cut staves with their croze, tapered shingles, etc.

A lever handle for agricultural implements has been patented by Mr. William E. Wagner, of Sheridan, Wyoming Ter. This invention relates to ratchet or bolt levers such as commonly employed, the lever having a handle extending at right angles, with a bolt or ratchet trigger having a handle extending in a line substantially parallel with that of the lever handle, so that in throwing the lever proper the trigger handle may be held against the lever handle without undue strain on the part of the operator.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER NUMBER.

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2. Plate in Colors of a Frame Dwelling, situated at Belleville, N. J., costing Two Thousand Five Hundred Dollars, with full specifications, floor plans, sheet of details, etc.
3. Page Engraving of Holbrook Hall, New York City, an Eight Story Apartment House, lately condemned for dry rot.
4. Plans for a School House costing between Eight and Nine Thousand Dollars.
5. Half page Engraving of a Residence at Battenhall Park, Worcester, England.
6. Perspective view, with floor plans, of a Dwelling costing Four Thousand Five Hundred Dollars.
7. Drawing of a Reception Pavilion, Geneva.
8. Illustration of the New Railroad Men's House, New York. A Club House costing One Hundred Thousand Dollars.
9. Design of an Attractive Residence at Minneapolis, Minn.
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13. Page Engraving of the New Monument and Tomb of M. Thiers, Cemetery of Pere la Chaise, Paris.
14. Design for an Entrance. Half page engraving.
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16. Design for a City Front. W. H. Powell, Architect, London.
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The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

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Special.

AFTER THIRTY YEARS.

That the spine and brain are intimately connected, all who have ever had spinal disease, or who have witnessed the sufferings of any one afflicted with it, can attest. The suffering generally is of the keenest character, and usually greatly prolonged. It seems a mystery how the human frame can survive the agonies frequently endured, and one is led to wonder if the body is not toughened in the flame of pain so that it is made capable to endure more pain. The *Warren Republican*, of Williamsport, Warren County, Indiana, printed the following in August last:

"Rev. Colbrath Hall, of Pike, was in town yesterday, looking hale and hearty. He reports the wonderful recovery of his wife within the last eighteen months, after being a confirmed invalid for over thirty years from spinal trouble. She, about eighteen months ago, began the use of the Compound Oxygen Treatment, and attributes her recovery to the use of that medicine. She is now able to walk, get into and out of the buggy, take rides, etc. All acquainted with Mr. Hall and his family will rejoice with them in this remarkable recovery."

In a letter dated West Lebanon, Indiana, September 2, 1885, Mrs. Sarah H. Hall wrote, inclosing the article and pronouncing it correct.

Send to Drs. Starkey & Palen, 1529 Arch Street, Philadelphia, Pa., for the last number of HEALTH AND LIFE, which is sent free to all applicants; also the treatise on Compound Oxygen, a valuable little book of two hundred pages.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Lathes for cutting irregular forms a specialty. See ad. p. 285.

Wanted—Large second-hand slotting machine, in fair order. Address, with full particulars, "Slotter," P. O. Box 773, New York.

For the best and cheapest 4 Horse Engine, address Peter Walrath, Chittenango, N. Y.

All Books, App., etc. cheap. School of Electricity, N.Y.

Perforated metals of all kinds for all purposes. The Robert Aitchison Perforated Metal Co., Chicago, Ill.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Link Belting and Wheels. Link Belt M. Co., Chicago.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder*." A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

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Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

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We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 and 421 East 8th Street, New York.

Hartford drill chucks. 3 sizes. Hold to ¼ in., ½ in., and ¾ in. Cushman Chuck Co., Hartford, Conn.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Friction Clutch Pulleys. D. Frisbie & Co., N.Y. city.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

Graphite Lubricating Co., Jersey City, N. J. Graphite bushings and bearings, requiring no grease or oil.

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A clergyman, after years of suffering from that loathsome disease, catarrh, and vainly trying every known remedy, at last found a prescription which completely cured and saved him from death. Any sufferer from this dreadful disease sending a self-addressed stamped envelope to Prof. J. A. Lawrence, 212 East 9th St., New York, will receive the recipe free of charge.

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Best belt hooks are Talcott's. Providence, R. I.

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NEW BOOKS AND PUBLICATIONS.

ENGLISH AND AMERICAN RAILROADS COMPARED. By Edward Bates Dorsey, C.E. New York: John Wiley & Sons. 1887. Pp. 142.

This book contains an essay for which the Norman gold medal was awarded by the American Society of Civil Engineers. The least we can say of it is that the medal was most worthily bestowed. The work is an exhaustive review of financial and other data of English and American railroads, a summary statement of the good and bad points of both, and a general comparison of results. As regards work done by given amount of rolling stock, locomotives, etc., the comparison is largely in favor of the American system. Yet the author condemns the weak points of American practice without hesitation. Especially does he speak of the lack of the block system. This is to his mind, and very properly, a *sine qua non* of good railroad work. The narrowness of the English cars is quite striking. Owing to the construction of their stone station platforms, bridges, etc., the car bodies cannot be widened. Hence the Pullman cars are much narrower than with us. The story of an American engineer receiving 2,000 guineas for two hours and a half testimony before a parliamentary committee has, to the patriotic practitioner, a very pleasant sound. We commend the book to all interested in the railroads of the world.

ELEMENTS OF MODERN CHEMISTRY. By Adolphe Wurtz. Third American edition. Translated and edited by Wm. H. Greene, M.D. 132 illustrations. Philadelphia: J. B. Lippincott Co. 1887. Pp. 770.

This admirable little work is well worthy of its distinguished author. It gives in clear and intelligible order the modern views of chemistry, representing about such a work as the well known Fownes' Chemistry. It is, according to the author, designed as a text book, but few chemists are not at frequent intervals indebted to such manuals as a quick and ready reference in the course of their work. Mendelejeff's law and the other recent chemical discoveries or theories find a place in it. The division and arrangement is the regulation one, beginning with hydrogen and going on through the elements, metalloids, and metals, to organic chemistry. This is fully treated, and forms a most valuable part of the work. The illustrations are, to a great extent, the familiar ones, but they form quite an essential portion of the book.

WITHIN AND WITHOUT. Chicago: J. Thompson Gill, Manager C. & B. Publishing Co. 1887. Pp. 318.

This is a novel supposed to touch upon philosophy, legal ethics, and religion. It is in four parts, and seems to be very brightly written. We are not prepared to give an elaborate opinion on the author's views, which we find summarized in the introductory pages.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) C. S.—The fine standard rules, calipers, and scales of steel for machinists' use have their divisions cut in a dividing engine, the cutter being similar to a diamond lathe tool. It is only the cheap squares and scales that are stamped. A few scales and tape measures are printed and bit with acid. These are readily recognized on inspection.

(2) P. G.—For metallic putty joints for flanges: To equal parts of white lead and dry oxide of iron (Prince's metallic paint) add their bulk of fine cast iron borings (sifted); mix and knead with the hands, adding boiled linseed oil sufficient to make the mass a stiff putty. Lay this under the flange about three-sixteenths inch thick, draw the flange down with the bolts, hammering the flange all around to bring it to a solid bearing. Rust joints are only made in socket joints, or in places where the borings can be driven with a calking tool.

(3) A. W. M. asks the best method of protecting a 1 inch steam pipe laid underground. A. A wooden box 4 inches in diameter inside for 1 inch pipe, coated with tar or asphalt, with notched cleats every 12 feet to retain the pipe in the center of the box. Fill in around the pipe loosely with mineral wool or pulverized charcoal, and cover without nailing, to facilitate repairs if ever found necessary. Lay tar paper over the joints of cover.

(4) P. J. F. asks: How is the resinous and foreign matter precipitated in alcoholic solution of Jamaica ginger, retaining the strong aroma of the ginger? A. By shaking the fluid extract with ¼ its weight of magnesium carbonate and filtering. 2. How is soluble essence of lemon prepared, so that when diluted with water and sirup it retains the strong aroma of lemons without the essence or oil floating on the surface of the water and sirup? A. Take fresh lemon peel, which, after removing the white, pulpy portion and grinding, is macerated with dilute alcohol.

(5) J. M. H.—For restoring the broken teeth of a gear for the purpose of a pattern, we think there is nothing cheaper or easier worked to the required form than plaster of Paris. Drill a few small holes in the broken surface of the tooth, drive in some wooden pegs, and build up the tooth with plaster. After setting it can be readily shaved to shape, which if not obtained at the first effort, more plaster can be added and the surplus shaved off to make the tooth perfect. When finished, varnish with shellac as with other patterns.

(6) J. W. P. asks about the process of annealing cast iron, and whether it can be done on a small scale to advantage. A. Castings of moderate to very small size, that are hard, can be readily annealed by packing in a cast iron box or a blacklead crucible, with burnt core sand or old moulding sand mixed with a little pulverized charcoal. Heat to a full red in a forge fire or furnace if convenient. Retain the red heat for an hour or two, according to hardness of castings; then allow to cool slowly by covering the fire and allowing it to die out. A few trials will suggest the proper time for keeping up the heat.

(7) A. T. W.—The elevation of the outer rail does not compensate for the difference in length of the outer and inner rail on a curve. Generally, in a free run around a curve, the inner wheel slips because the centrifugal force throws the flange of the outer wheel hard against the outer rail, producing additional friction and pressure upon the outer rail. This may be reversed when, by slow speed, the engine has a live pull on the train when rounding a curve; then the wheels are pulled hard against the inner rail, and the centrifugal force is not equivalent to the draught of the engine.

(8) T. E. C. asks: 1. Is there any way to remove the nickel from brass articles that were imperfectly plated? A. The only way is to refinish. Acids will roughen the surface. 2. How to "snell" brass. A. Do not know the term. 3. How many minerals are known to science, and which is the most valuable? A. Several thousand. The diamond is most valuable. If you mean metals, there are 54 elements counted as metallic, though scientists do not all agree as to several of them.

(9) O. T. asks: What is there that will keep a liquid made of egg and acid phosphate without changing the taste? A. Add a small quantity of salicylic acid.

(10) J. R. W. desires a good receipt to clear the voice and remove temporary hoarseness caused from speaking and singing. A. Take of beeswax two drachms, copaiba three drachms, powder of licorice root four drachms; melt the copaiba balsam with the wax in a new earthen pipkin; when melted, remove them from the fire, and mix in the powder; make the pills of three grains each. Two of these pills to be taken occasionally three or four times a day.

(11) W. L. R. asks: 1. What is the greatest perpendicular height that water can be raised with a suction pump? A. About 28 feet is all that can ordinarily be depended upon, 33 feet being about the ultimate limit. 2. How many cubic inches are there in one gallon, and is the American gallon or imperial gallon used for measuring capacity of tanks? A. A standard gallon U. S. = 231 cubic inches, and is equivalent to the old English wine gallon. The imperial gallon is not recognized in the United States. It is 277·274 cubic inches.

(12) J. W. S. asks about how many tons of coal the Cunard steamer Umbria consumes per day. A. About 350 tons.

(13) G. W. L. asks: 1. Is there any paint for buoys, so that they can be seen when dark? A. You can try luminous paint. 2. What can I apply to a rope to keep it from rotting? A. Dissolve 1 pound zinc sulphate in 40 gallons of water and then add 1 pound of sal soda. After these ingredients are dissolved, add 2 ounces of tartaric acid. Soak the rope in this solution for 24 hours, and then dry without wringing.

(14) H. P. asks whether a steam horse power is equal to three actual horse power. A. The actual working power of a horse varies ver much. Experiments give from ⅛ to ¾ of the assigned horse power of 33,000 pounds raised 1 foot per minute as the usual work of horses. Steam engines are counted according to the theoretical horse power, and frequently exceed their rating even on this basis.

(15) W. M. S. asks: 1. How is steam carried between the cars for steam heating? A. By rubber hose, with a coupling made for steam pressure. 2. Does it freeze between the cars? A. No; it would, if not disconnected when not in use.

(16) W. E. G. asks if there is any process by which china and pottery of any description can be cut or sawed without breaking or chipping. A. The process of cutting china and pottery is the same as for glass, which you will find in SCIENTIFIC AMERICAN SUPPLEMENT, No. 318. Use a thin wheel of copper, as illustrated, for sawing.

(17) C. G. B. writes: I have gained many valuable suggestions from your paper, and I thought you might be interested in the way you can make a nice-looking hall lamp out of a tin can, such as you will find in any grocery store; they are used to put up all kinds of spices in, and are made very nice, and just the right size, 12×7. Where the cover comes off, make a band of tin about 2 inches wide. Cut out nicks. Any tinsmith will make you a door in one side for 50 cents, and then cut out each side and put in glass plates such as are used for butter plates or sauce plates. I had a friend who painted mine in imitation of stained glass, and the effect is very beautiful when the light is placed inside. Then I took a round awl or any sharp-pointed instrument, and punched little holes all round in a fancy design, and hung glass pendants on the bottom, and then bronzed the can, and you would not know but what I paid $12 for my lamp, and all this lamp cost was one dollar and fifty cents and a few hours' work evenings.

(18) W. H. D. asks how to emboss on silk with gold or silver leaf with a warm stamp without staining silk. A. Dust the surface of the silk with finely pulverized gamboge, through a sieve made by stretching the finest cambric over a short tube of pasteboard or tin. Heat the stamp and take up the gold or silver foil and press upon the surface. The silk should lie upon a hard cushion. Afterward dust off the loose powder and leaf with a piece of cotton wool.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

October 18, 1887,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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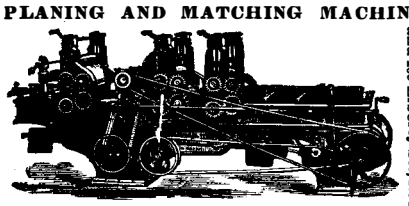

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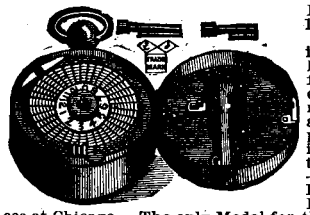

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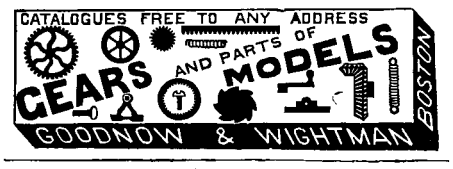

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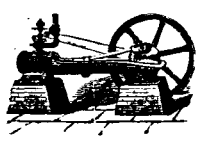

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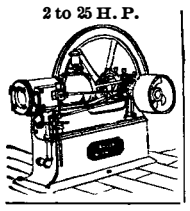

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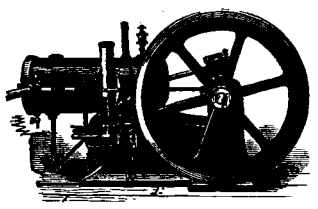

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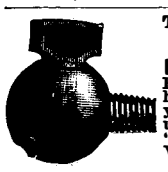

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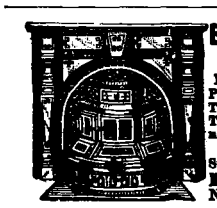

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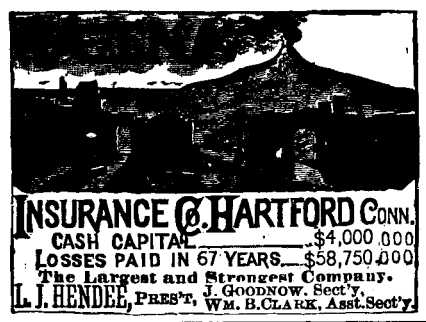

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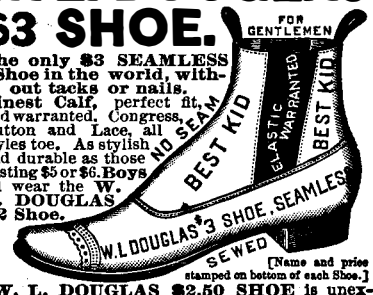

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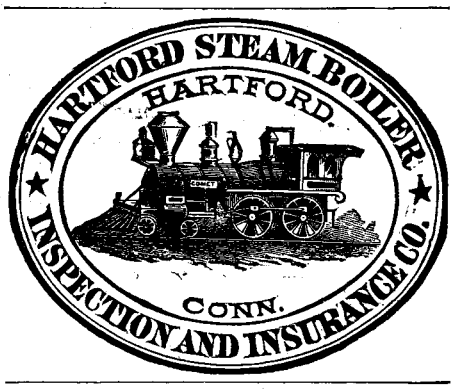

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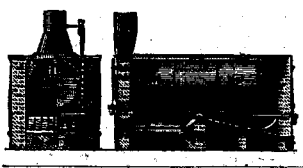

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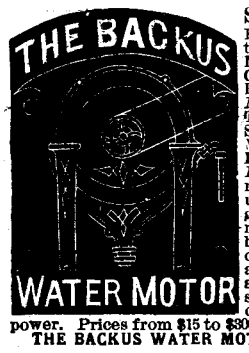

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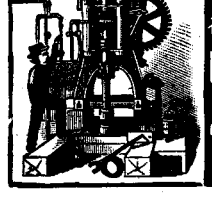

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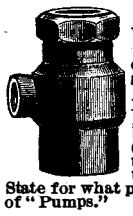

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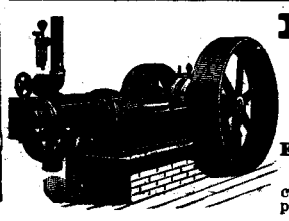

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